NAVAL POSTGRADUATE SCHOOL

Monterey, California

LEVEL II

(12) 96p.

(1) Master's THESIS,

(6) PSYCHOLOGICAL, SOCIAL AND ATTITUDINAL VARIABLES ASSOCIATED WITH INFANTRY COMBAT EFFECTIVENESS AND THEIR RELATION TO WOMEN.

by

(10) Phillip Karl Carreon

(11) Jun[redacted]79

Thesis Advisor: R. S. Elster

Approved for public release; distribution unlimited

79 [illegible] 135

251 450

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Psychological, Social and Attitudinal Variables Associated with Infantry Combat Effectiveness and their Relation to Women		5. TYPE OF REPORT & PERIOD COVERED Master's Thesis; June 1979 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Phillip Karl Carreon		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Postgraduate School Monterey, California 93940		12. REPORT DATE June 1979 13. NUMBER OF PAGES 95
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) Naval Postgraduate School Monterey, California 93940		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

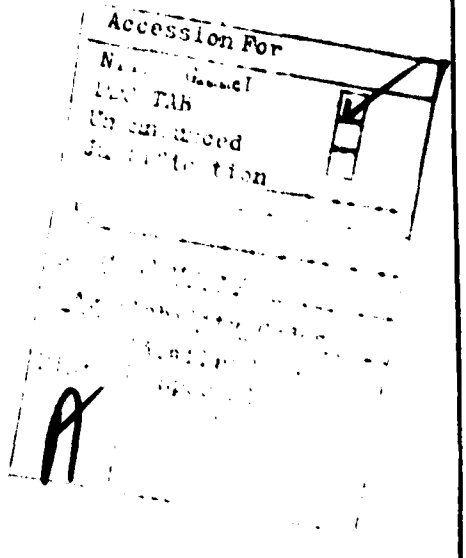
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Currently, consideration is being given to opening up combat occupations to women. This thesis reviewed relevant literature in the fields of psychology and sociology, and found that several individual and group variables (body dimensions, personality, activity level, and social cohesion) were related to adequate combat performance. The results of the literature search suggest that women may not be as well suited to combat as are men.

DD FORM 1 JAN 73 1473 (Page 1)
EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-014-6601

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

In addition, 55 graduate students were asked to rate 51 jobs as to suitability for women. The results of the questionnaire were analyzed using multidimensional scaling and cluster analysis. The analysis resulted in the identification of two criteria that appear to have been used by the subjects to rate the jobs: traditional masculine/feminine occupations, and the degree to which a job was or was not physically demanding.



79 09 24 135

Approved for public release; distribution unlimited

Psychological, Social and Attitudinal Variables Associated with Infantry Combat Effectiveness and their Relation to Women

by

Phillip Karl Carreon
Captain, United States Marine Corps.
B.A., The University of California, Riverside, 1971

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN OPERATIONS RESEARCH

from the

NAVAL POSTGRADUATE SCHOOL
June 1979

Author Phillip Karl Carreon

Approved by: Richard L. Elster
Thesis Advisor

James G. Taylor
Second Reader

Chairman, Department of Operations Research

W. M. Schrady
Dean of Information and Policy Sciences

ABSTRACT

Currently, consideration is being given to opening up combat occupations to women. This thesis reviewed relevant literature in the fields of psychology and sociology, and found that several individual group variables (body dimensions, personality, activity level, and social cohesion) were related to adequate combat performance. The results of the literature search suggest that women may not be as well suited to combat as are men.

In addition, 55 graduate students were asked to rate 51 jobs as to suitability for women. The results of the questionnaire were analyzed using multidimensional scaling and cluster analysis. The analysis resulted in the identification of two criteria that appear to have been used by the subjects to rate the jobs: traditional masculine/feminine occupations, and the degree to which a job was or was not physically demanding.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

In May, 1979, a newspaper article reported that the American Civil Liberties Union might sue to challenge the United States Army's decision to close twenty-two combat or combat-related jobs to women [Ref. 1]. This thesis attempts to explore the psychological, social and attitudinal variables involved in ground combat and their possible implications for women.

As long as differences between societies are settled by warfare, the need for strong armed forces will remain. Strong armed forces, especially ground forces, require a large number of trained personnel to fill out the ranks. During World War II, one of the critical shortages that came up was a shortage of infantry replacements [Ref. 2]. That shortage was relieved by transferring men from less critical billets to the infantry. The U.S. Army currently faces some manpower shortages (such as in reserve units) [Ref. 1]. This time, the Army, as well as the other armed forces, has turned to women as an answer to the shortage of men.

However, one of the primary tasks of the ground forces is ground combat, and women are prohibited from serving as combat infantry in the United States. Women have regularly served the U.S. Armed Forces, especially in wartime, but rarely as combatants. In fact, world history provides few instances of female warriors as compared to the overwhelming use of male combatants [Ref. 3].

Before the time of universal physical examination, a woman could disguise herself as a man and thereby join an armed force.

This use was often successful for a surprisingly long time [Ref. 4]. One outstanding example was Lucy Brewer of the United States Marine Corps. She was a prostitute in Boston in 1812, who was working off a debt to her madam in a brothel. She excaped by dressing as a man and enlisting as a United States Marine under the name of George Baker. She was assigned to the U.S.S. Constitution where she fought as a marksman in the rigging for three years. During those years, the U.S.S. Constitution was in several major actions including the famous battle with the H.M.S. Guerriere. She escaped detection during that time and finally returned home to her parents and wrote her memoirs [Ref. 4].

Several other such cases are known to exist and many more are suspected [Ref. 4]. Some women such as Mary Hays (Molly Pitcher) fought openly as women. In more recent times, women have borne arms as guerrillas. The outstanding documented examples are of women in Soviet partisan units and in the French Resistance Movement [Refs. 4, 5]. Women as individuals have performed well under fire. It has been estimated that 100,000 women fought in WW II in irregular units [Ref. 6].

Great care however should be taken in generalizing these accounts to all women. The women who fought were in all likelihood a very select portion of the population. They were highly motivated by personal circumstances or the desperation of the national situation. It should be noted that, in comparison to men, women were virtually absent from the battlefield, regardless of the situation. Unfortunately, accurate data about exact numbers do not exist.

There have been several all-woman infantry units formed. For instance, the King of Siam's Guards and the female warriors of the King of Dahomy. The Siam females never participated in combat, but the Dahomy females did and were renowned in Africa as infantry soldiers. In the mid 1800's, the King of Dahomy recruited and trained many thousands of young women in order to shame the male warriors. The female warriors faced regular British and French troops in battle and earned a reputation as formidable soldiers. In 1851, between 6,000 and 10,000 of the Dahomy warriors took part in a battle for the fortified town of Abeokuta. The attack failed after a fearsome battle. Only 1,200 women survived the battle which reduced Dahomy to a minor power [Ref. 4].

The Soviet Union has probably had the most experience with female combatants in the 20th century. A female battalion was raised during the First World War. It later broke and fled at the onset of the Bolshevek Revolution [Ref. 7]. During the same revolution, a female company was credited with saving a male regiment. Women also fought alongside men as machinegunners, riflewomen and as irregular forces [Ref. 5]. However, World War II saw large scale use of women warriors in the Soviet Union. Women carried machineguns, volunteered as snipers, flew fighters and bombers, drove tanks and fought as partisans [Ref. 5]. In comparison, women in the U.S. Army in World War II served primarily in administrative, supply, medical and other non-combatant jobs [Ref. 8].

Contrary to popular opinion, the Israeli experience with women in combat has been minimal. During the 1947-1948 wars, some women were wounded or killed defending settlements [Ref. 3]. However, Israeli women have not been combatants since then. Women hold jobs as clerks, nurses and drivers, but not combatants. The stirring pictures of young Israeli women holding sub-machineguns or marching smartly down streets seem to be more propaganda than a display of female martial prowess [Ref. 9].

The question of the combat effectiveness of women still remains to be answered. A possible answer could come from comparing men and women using those human characteristics, e.g., aggressiveness, strength, etc., that probably affect performance in ground combat. Unfortunately, no one is sure how these human variables affect combat outcomes. An example of this is aggressiveness. In some cases, as in the Japanese Banzai charges of World War II, aggressiveness proved suicidal and tactically unsound. Also, human attributes are notoriously hard to measure and disagreement exists on exactly how men and women differ on certain traits. While there is strong evidence that men are more aggressive than women, for example, there does not seem to be any wholly satisfactory scale of aggressiveness with which people can be measured [Ref. 10, 11].

The importance of the human element in combat cannot be questioned. However, much more military combat effectiveness research has been done on hardware than personnel. Without trained human beings who willingly risk their lives, the most advanced battlefield weapons are just so much steel, copper and

aluminum -- as the Egyptians so painfully learned in their confrontations with the Israelis. Thus, it is probably safe to say that the human element is at least as important as hardware to combat effectiveness, if not more so.

Several studies have been done linking human characteristics with good and poor male combat performance. This thesis attempted to extend these studies to women. While not definitive, the data suggest that, in general, women may not be as suitable as men for ground combat jobs. There is no doubt that some women have performed well in combat. If the armed forces were seeking a small number of women for ground combat units, such women could probably be found. Human variability is such that some women (men) can be found who surpass the majority of men (women) on almost any measurable human characteristic [Refs. 12, 13]. The problem remains, however, of determining the human characteristics important for satisfactory performance in ground combat.

II. COMBAT AND THE ROLE OF COMBAT MODELS

A. NATURE OF COMBAT

After WW II, it was very popular to proclaim the age of Pax Americanus. The United States possessed the long range B-36 bomber and the atomic bomb. War, it was said, was no longer possible when the U.S. could impose its will over any other nation by threat of nuclear holocaust [Ref. 2]. Push-button wars were at hand. World events have proved that push-button warfare was a myth.

Modern warfare has placed great emphasis on mechanization, armored forces, and aircraft. The concept of push-button warfare has been disguised as machinery. As women can push buttons, so can they ride in armored personnel carriers, drive tanks and fly airplanes. So, it is argued, women can fight modern wars as well as men.

Several years ago, during training at the Basic School, newly commissioned Marine officers were told the following story: During movement to contact with the enemy, we first take the enemy under fire with bombers and long-range artillery. As we get closer, we open up with medium and light artillery as well as close air support. Soon, we fire with 81mm mortars, tanks and recoilless rifles. Before we assault the enemy position, we set up a base of fire with machine guns and small arms. Then we close with the enemy using fire and movement and finally we will get close enough to get on line and assault his position, firing

It has been a fact of military life that a well dug in enemy has been nearly impervious to conventional firepower. The Marines learned at Tarawa, and thereafter, that intense bombardment by air and naval gunfire was not nearly sufficient to destroy the enemy forces [Ref. 14]. Throughout the entire island hopping campaign of WW II, the enemy had to be blasted and burned out of each defensive position by infantrymen. More recently, in Korea and Vietnam, the enemy went underground to neutralize the U.S. superiority in firepower. In Vietnam, the enemy used concealment and dispersion as well. Infantry was required to find, fix and destroy the enemy.

Machinery has greatly increased the violence of the modern battlefield, but it is unlikely to replace infantry. Col. T. N. Dupuy [Ref. 15] has documented several trends in warfare that illustrate this point. First, the lethality and power of weapons has grown enormously from antiquity to the present day. Second, "The incidence of casualties on the battlefield has declined as steadily as the power of weapons has grown"[1] (see Table I). He explains this apparent paradox by pointing out that troop dispersion has increased even faster than weapon power has increased (see Table II). The steadily increasing power and accuracy of conventional weapons has made any concentration of men and materiel extremely vulnerable to opposing weapons. Thus armored personnel carriers (APC's), tanks, trucks and aircraft are vulnerable, but the individual soldier may be less vulnerable because he is not

---

[1]Dupuy, T. N., "How Lethal," Army, p. 24, February 1979

TABLE I

PERCENT CASUALTIES PER DAY

ENGAGEMENT	VICTOR'S CASUALTIES	LOSER'S CASUALTIES
Thirty Year War	15	30
Fr. Revolutionary Wars	9	16
Napoleonic Wars	15	20
Mexican War	8	15
Amer. Civil War	12	16
World War I	3-5	4-7
World War II	1-2	2-3
1973 Middle East War	1-2	2-3

Dupuy, T. N., "How Lethal," Army, p. 24, February 1979

TABLE II

HISTORICAL ARMY DISPERSION PATTERNS

	ANTIQUITY	NAPOLEONIC WARS	AMERICAN CIVIL WAR	WW I	WW II	OCTOBER WAR
Area Occupied By Deployed Force 100,000 Strong (Sq. km)	1.00	20.12	25.75	248	3,000	4,000
Front (km)	6.67	8.05	8.58	14	50	57
Depth (km)	.15	2.50	3.0	17	60	70
Men per sq. km	100,000	4,970	3,883	464	33	25

Dupuy, T. N., "How Lethal," Army, p. 24, February 1979

a lucerative target for guided missiles. He also can take advantage of cover and concealment much more easily than can a 50,000 pound tank. As the violence of modern weapons increases, troops and equipment will probably be further dispersed.

Modern infantry consists of several different types. There is mechanized infantry, airborne infantry, airmobile infantry and "straight leg" infantry. Mechanized infantry rides into battle on APC's. Airborne infantry rides into battle on airplanes and jumps out when close to their objective. Airmobile infantry rides to war on helicopters. Straight leg infantry uses whatever mobility is at hand, and marchs into battle if necessary. It should be noted, however, that in very few cases do infantry fight from their vehicles. In most cases, they ride close to their objective, dismount and fight on foot. In a defensive situation, all infantry fight on foot from covered positions. Mechanization has increased the mobility of modern infantry, but actual combat is still done on foot the old fashioned way.

Precluding a nuclear holocaust, warfare in the foreseeable future will continue to rely on the availability of large numbers of well trained infantry [Ref. 16]. U.S. forces prepared to defend Europe consist of both armored divisions and mechanized infantry divisions. However, the mechanized infantry has organic tanks and armored divisions have organic infantry. This again underlines the importance of infantry. U.S. combat doctrine emphasizes the "combined arms" approach. That is, tanks, infantry, close air support and artillery work as a mutually supporting team to minimize the weaknesses of each combat arm while taking

full advantage of the strengths of each. Modern infantry is an indispensable part of the combined arms team. Infantry combat will probably be at least as dangerous, dirty and exhausting as it has always been, if not more so.

B. THE COMBAT INFANTRY PERSON?

What are the critical factors that determine success in ground combat and what effect would the introduction of a large number of women have on infantry forces? No hard data exist on performance of female infantry personnel and, in fact, very little systematic and detailed data exist on male infantry performance in combat. Also, there is very little military experience with female combat forces. Thus, predicting the potential of female infantry personnel will be very difficult. However, the actual data gathered in combat have proven to be useful in understanding the effectiveness of men in combat, and indicate what direction research should take in trying to estimate the combat effectiveness of women.

During WW II, a U.S. Army historian, S.L.A. Marshall, made a surprising discovery while gathering historical data from front line infantry units. He found that in most battles only 15% of the soldiers engaged in the battle actually fired their weapons. In some exceptional rifle companies, as many as 25% of the men fired their weapons. He further observed that men who fired their weapons started firing early in the action and continued throughout the action. In subsequent actions, the same individual tended to actively participate in the battle. Marshall concluded that the active participants were somehow different from the

other soldiers [Ref. 2]. Infantry battles were won or lost by a small percentage of the engaging forces. These startling facts seem to have been missed by the officers and NCO's of these units, even though they were with the men during the engagements. When the results were published in 1947, they were widely disputed by professional military men. However, they were ultimately accepted and changes to training were made so that by the Korean War over 50% of the men fired their weapons, and as many as 100% fired in some perimeter defenses, according to Marshall. This was due in part to new training techniques and also to awareness by unit leaders who actively checked men under fire to ensure they were firing.

Another discovery by Marshall was that the relatively few active participants in a battle could make a decisive difference in battle outcome. For example, the battle for Omaha Beach on June 6, 1944, was a bitterly fought infantry battle with heavy U.S. casualties. Omaha Beach was a two division front and along this front, only six rifle companies were relatively effective as units. Approximately eighteen were shattered before contributing anything. According to Marshall, forty-seven men, at widely scattered intervals along the beach, saved the day from disaster. Marshall carefully documented this battle and the number of active fighters appeared to be a crucial determinant of combat effectiveness [Ref. 17].

A second study, Fighter I [Ref. 18], estimated that the percentage of active combat participants, or fighters as they were called, was between 15% and 20% in the combat units studied

in Korea. This further confirmed Marshall's discovery, and indicated that perhaps some men are better suited for combat than others.

Assume for a moment that there exists a fixed percentage of men who are effective fighters. Careful selection could theoretically raise the proportion of fighters in a unit and make it more effective. Suppose that the proportion of women that are fighters is also fixed. Then it would also be possible through careful selection to increase the proportion of fighters in a unit. Thus, if it were possible to predict combat performance perfectly, it would make no difference as to whether combat soldiers were male or female, they would all be effective (as long as supply met demand, so selection could be exercised).

However, perfect selection is not possible. Improved training methods offer a possibility for increasing the percentage of fighters. In Korea, Marshall noted that the number of men firing their weapons had increased. He credited this to improved training and to officers who were aware of the problem and moved among the men urging them to fire [Ref. 1]. Unfortunately, Fighter I did not confirm Marshall's findings [Ref. 18]. Fighter I estimated that the percentage of fighters was the same in Korea as in WW II. Thus, the proportion of fighters in all male units may remain at around 15% to 20% of a unit. If the proportion of women who are fighters is identical to men, then the introduction of women into combat units (with selection policies the same as for men) would have no effect on the overall proportions of fighters. However, if the proportion of women fighters differs significantly from

men, then the overall proportion of fighters could change. For example, suppose that the percentage of women fighters was 5% of the population, then, with no selection, the expected number of fighters in a unit with equal numbers of men and women would be 12.5%, assuming that the proportion of male fighters was 20% (see Figure 1). This would give an overall percentage of fighters of 12.5%. While there exists a sound estimate of the proportion of males who will be fighters, there does not exist a similar estimate for females.

The evidence reviewed suggests that a relatively small proportion of soldiers actively carries the fight to the enemy in times of war. This percentage appears to be in the vicinity of 15-25%. These fighters are apparently crucial to the outcome of infantry battles. Raising the proportion of fighters in a unit would probably increase the combat effectiveness of the unit. Lowering the proportion would have a detrimental effect. If the proportion of women fighters is less than the proportion for men, then introducing large numbers of women into combat units would tend to lower the proportion of fighters to the detriment of the unit unless valid selection procedures are used.

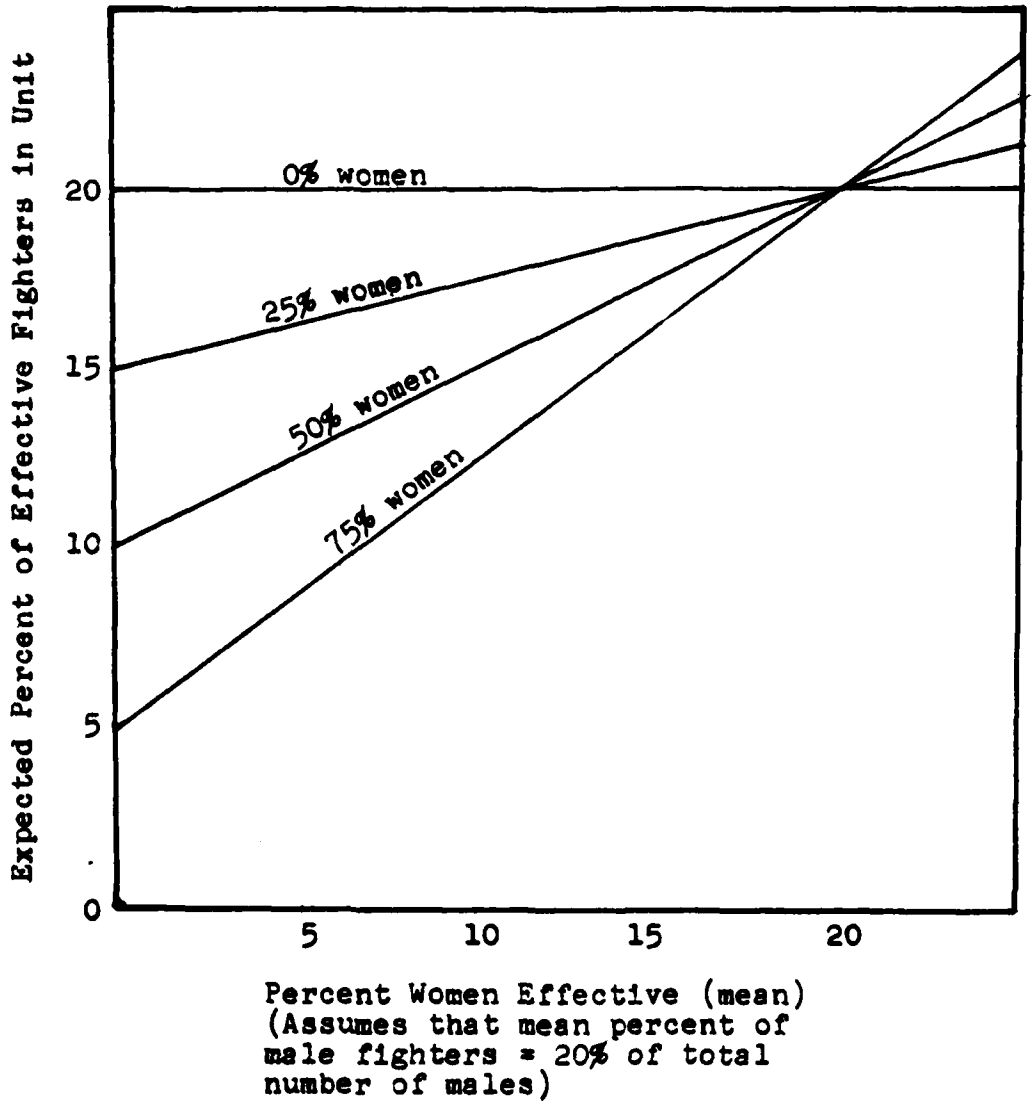
C. COMBAT MODELING

1. Introduction

Testing new items of combat equipment or new tactics has always been difficult. During times of war, researchers rarely have time to test equipment in actual battle, and in times of peace no wars are available to test equipment or ideas. Even in times of war, due to the large number of variables in each battle,

FIGURE 1

Expected Percent Effective Fighters in Unit
(Assumes no selection of women
on combat effectiveness predictors.)



the contributions made to battle outcome by a single item is difficult to measure. Ideally, a battle should be fought under similar circumstances a number of times. Then an item under test should be introduced and the battle re-fought several times to see if the new item had any effect on battle outcome.

Obviously such a test method is impossible in actuality. However, using the techniques of combat modeling, battles can be created and recreated under identical circumstances. Researchers can then document the changes to battle outcomes caused by the introduction of new equipment or doctrine. The power of combat modeling is repeatability of results. The possibility of assessing the combat effectiveness of women using combat modeling is appealing.

2. Combat Models

All combat models are abstractions and simplifications of reality. Since a model is a representation of reality, combat models may be taken to include military field exercises and experiments, map exercises, war games, computer simulations and mathematical equations. All have been used to model combat. However, this portion of the paper only considers the latter three types of models.

War games typically involve two opposing groups of players who represent opposing commanders and their respective staffs. The commanders and their staffs make decisions which effect the course of the war game. Engagement results are either determined stochastically, or an umpire may make a judgement based on experience, depending on the war game involved.

In even a simple war game, bookkeeping can be overwhelming. Opposing forces must be tracked, engagements determined, communications sent and a myriad of other details followed. In some cases, computers have been used to do the bookkeeping. However, war games, even if computer assisted, may take years to develop and may take many days or even months to play out a battle only a few hours long.

War games are well suited as a training mechanism for commanders and staff members, and they may reveal flaws in battle plans or communication problems. However, experience with a wide variety of models has not proved useful for detailed testing of alternative weapons systems [Ref. 19]. War games would not be a viable way to assess the effectiveness of women in combat.

Machine simulations, which run without human participation, are among the more popular forms of combat models. This popularity is possibly due to the complexity and microscopic detail present in most machine simulations. It is not unusual for simulations to model individual vehicles and even each projectile as it is fired. Terrain features can be modeled and line-of-sight considerations can be incorporated. Thus, it appears that machine simulations are isomorphic with the complexities of the modern battlefield.

To develop a simulation, a detailed study of the processes of a battle must be undertaken. The course of a simulation may be ordered by critical events occurring during the simulation. Such events may include rounds fired, vehicles destroyed, ground covered and supplies used. In the so called Monte Carlo

simulation, a large number of probabilistic events are incorporated. Each event must have a probability distribution connected with it. It may be a simple constant or a complex variable. For example, the probability of firing, given line-of-sight, may be unity. The probability of a hit may be a simple function of range and the probability of a kill given a hit may be a function of range, projectile type and aspect angle of the target.

Much of the input data required by detailed simulations is in the form of probability functions. Some can be obtained by firing range data or from other experimentation. Other data are simply not available and must be determined judgmentally. Hardware performance data such as kill probabilities are normally quite well known and modelled. Processes such as movement patterns are not known at all, and must be assumed to a large extent. Human factors such as bravery, training, morale, physical conditioning, determination, aggressiveness, group cohesiveness, and other similar factors simply have not been quantified for use by combat modelers.

Human variables have not even been manipulated into combat models for the case of all male units, let alone to male and female combat units. Innate differences between men and women are denied by some, and the disputes concerning sex differences are far from settled in any case [Ref. 11]. Physical processes of machinery are generally well understood and have been modelled. That is, physical processes can be quantified and incorporated into models. Many human factors have not been adequately measured.

Analytical models substitute mathematical equations for discrete simulations of real objects. While analytical models may be deterministic or stochastic, a single set of input values will give the same answer. In the stochastic case, the answer will be in the form of a probability distribution. The analytical model may be so complex that a computer is required for solution. Nevertheless, it need only be solved once for each set of variables, unlike the Monte Carlo simulation which requires many replications for a solution to be apparent. The primary advantage of analytical models is their ability to clarify complex situations. One disadvantage is that they are too abstract to offer direct solution to operational problems in most cases.

These three types of models are essentially the only types of combat models which directly utilize large scale computers for direct solution. While there are other ways to classify models, the one described is sufficient to show that at present combat models are simply not adequate to provide definitive information about the combat effectiveness of women in infantry units. All combat models suffer from the lack of combat data and the difficulty of adequately describing combat interactions [Ref. 20].

> "I am firmly convinced that there exists almost no experimentally verified models of combat processes of interest to the military planner. That is, and let me emphasize, the field is devoid of any experimentally verified content...nor does it appear that sufficient historical or experimental data to test any existing or next generation models will become available in the near future."[2]

[2]Bonder, S., An Overview of Land Battle Modeling in the U.S., Proceedings 13th U.S. Army Operations Research Symposium, November 1974.

Bonder suggests that models are developed much like natural philosophy--through pure reason and logic [Ref. 19]. Models, he claims, are better suited to provide insight into system dynamics and provide data collection plans. Models should not be used to predict the outcome of future battles.

Further difficulties are encountered simply in trying to model the complexities of physical processes with mathematical equations. For example, detection of a target depends on many factors, some of which are not adequately understood: observer's visual acuity, target movement, camouflage, range, line-of-sight, obscuration, target signature from firing, as well as others. Obviously, detection will vary not only from observer to observer, but also from target to target. Human decision processes are especially difficult to understand. Factors such as when to engage, withdraw or what path to take are examples of such decisions.

Because of these two factors, lack of data and complexity, very few crucial infantry combat situations have been modelled (see Table III). The modelling of the influence of human differences is not possible with the present state of the art in combat models. A suitable model would allow the researcher to vary the number of women in a unit and observe variations in mission accomplishment. While appealing, this type of model does not exist presently, nor does it appear that such a model will be developed in the foreseeable future.

TABLE III

SMALL UNIT COMBAT MODELS

Homogeneous Forces	Organization	Maneuver	Target Acq.	Micro Intel.	Firepower	Communication	Battle and Battle Area	Deployment and Tactical Roles	Attack Routes	Tgt. Choices	Open Fire	Terminate Fire
Dismounted (squads)	NA	M * ✗	M TI ✗	M	M T ✗	M	M	M	M T *	M T A	M T A	M T A
Mounted (companies)	NA	M * ✗	M TI ✗	M	M T ✗	M * *	M	M	M T *	M T A	M T A	M T A
Armor/Armor	NA	M * ✗	M TI ✗	M	M T ✗	M * *	M	M	M T *	M T A	M T A	M T A
Artillery Duels	NA	NA	M T *	M	M T ✗	NA	M	M	M	NA	M T A	M T A
A.D.A./Air	NA	M * ✗	M T* A	M	M T ✗	NA	M	M	M	M T A	M T A	M T A
Hel./Grd Units	NA	M T* ✗	M TI *	M	M T ✗	NA	M	M	M	M T A	M T A	M T A
	Combat Processes							Human Decision Processes				

Legend:

M Model exists

T Tests conducted
I Inconclusive
V Verified

A Assumptions are reasonable

— Negation

/ Partial

* Don't know

NA Not applicable

Adapted from Bonder, S., An Overview of Land Battle Modeling in the U.S., Proceedings 13th U.S. Army Operations Research Symposium, November 1974.

III. STUDIES OF BEHAVIOR IN COMBAT

A. BACKGROUND

Combat soldiers, during war, face the possibility of prolonged and intense stress. Combat stresses include a variety of unpleasant, painful and dangerous situations. An individual is separated from family and friends and is rigorously trained. He may be transported to a foreign land with a hostile environment. He may be subject to extremes of heat or cold and may experience total physical exhaustion. During wartime, the threat of violent death may be present for weeks or months.

Most individuals adapt quickly but some suffer emotional breakdown almost immediately upon separation from familiar surroundings [Ref. 21]. Others break down only after prolonged exposure to intense combat. All individuals will probably break down eventually if exposure to intense combat is allowed to continue unabated. The upper limit to the number of combat days that can be tolerated appears to be between 180 and 250 [Ref. 22]. The success an individual has in adapting to combat seems to be related to a number of complex, interrelated variables. Some variables are related to the personality resources of the individual, such as emotional stability and self-confidence. Other variables are environmental such as length and intensity of combat, adequacy of training and rotational policy.

There have been some attempts to characterize the personality resources that an effective fighter carries with him into combat.

Marshall felt that effective infantrymen were somehow "different" from other infantrymen. He noted that those men who fought in one action would be the fighters in subsequent actions [Ref. 2]. In other words, combat effectiveness in an individual was stable over time. Another study, Fighter I [Ref. 18], measured a number of proven combat fighters and non-fighters at the end of the Korean War. This study assumed stability of combat effectiveness over time. An alternate point of view was presented by Swank and Marchland [Ref. 21]. They claimed that combat behavior changed over time. They identified four stages. The first stage was characterized as becoming "battle wise" covering the first 7 to 30 days of combat. This was followed by a period of maximum effectiveness. Then came a period of over reaction and mounting anxiety, followed finally by a feeling of total hopelessness and apathy. In a review of the above material, Kern [Ref. 23] felt that Marshall and the Fighter I researchers had observed a cross section of the four stages outlined by Swank and Marchland. Adequate combat fighters were in stage II and inadequate combat fighters were in stage IV. Kern felt that adequate training would increase the duration of stage II in many soldiers.

B. FIGHTER RESEARCH SERIES

The Fighter I study was one of a series of studies using actual combat data. No women were studied, but it did link human attributes with combat performance. It has never been replicated; so there may be some question as to its validity. However, it did offer insights into the behavioral aspects of

infantry combat. Fighter I may also provide clues in considering the question of women in combat.

The Fighter I study attempted to differentiate between fighters and non-fighters using a variety of tests and measurements. The research was done in the autumn of 1953 in Korea with men from the 45th, 2nd and 7th Infantry Divisions. The survivors of combat actions were interviewed individually. Each interviewee was asked to name two or three men he would most like to have had next to him during the engagements in which they were involved. Each man was then asked to describe specific incidents from combat experience to support the choices. When two or more men gave specific instances of good combat behavior or poor combat behavior (see Appendix A for definitions) for an individual, that individual was selected for participation in the research. In all, 345 men were selected based on specific, verified examples of effective or ineffective action in combat. Of the 345 men, 35 were lost due to combat attrition or rotation. This left 310 men who were eventually tested.

The men represented extremes on a presumed continuum of combat proficiency ranging from very good to very poor. Although exact percentages were not measured, the research team concluded that approximately the top (in terms of combat proficiency) 15 to 20 percent of the men in the company-sized units were tested as well as the bottom 15 to 20 percent. Thus, the middle 60 to 70 percent of the men were not rated who displayed neither exceptional fighting behavior nor exceptional non-fighting behavior.

The men were given a battery of 27 questionnaires and inventories as well as 60 objective tests. (See reference 18 for a list of tests.) In addition, the men were given a one hour clinical interview. In all, approximately 40 hours of tests and measurements were administered, making this possibly the most tested group of infantrymen in history. The researchers who administered the tests did not know which men were classified as fighters and which were classified as non-fighters until the termination of the testing phase. The men were not aware of the true purpose of the tests. Thus, the research was done in the double blind mode to reduce possible biases.

Analysis of the data revealed that racial difference dominated many of the measurements which seemed to differentiate fighter from non-fighter. Proprotionately more blacks than whites were named as non-fighters (see Table IV).

TABLE IV.

RACIAL MIXTURE OF SAMPLE

Sample	Native Born White		Black		Other		
	N	%	N	%	N	%	TOTAL
Fighter	134	67	18	21	14	59	166
Non-Fighter	67	33	66	79	10	41	143
Total	201	100	84	100	24	100	309

Egbert, R. L. and others, Fighter I: An Analysis of Combat Fighters and Non-Fighters, U.S. Army Leadership Human Research Unit, p. 15, 1957.

The researchers were unable to determine whether the disproportionate number of blacks classified as non-fighters was a result of racial prejudice. No information was gathered on the race of the soldier-raters. Thus, the determination was made to concentrate the analysis on the native born white sample to eliminate possible racial bias.

The analysis was able to show that the fighter tended to (as compared to the non-fighter):

1. Be more intelligent
2. Be more masculine
3. Be a "doer"
4. Be more socially mature
5. Be preferred socially and in combat by his peers
6. Have greater emotional stability
7. Have more leadership potential
8. Have better health and vitality
9. Have a more stable home life
10. Have a greater fund of military knowledge
11. Have greater speed and accuracy in manual and physical performance

The list of differences was extensive and tended to show a clear difference between the fighter and non-fighter in psychological, physical and social areas. However, the ground forces are faced with a very different problem. They would like to determine from a relatively undifferentiated group of men, who would tend to be better fighters. That is, the problem was to determine prior to combat what easily measured characteristics would tend

to identify potential fighters. What the ground forces could use would be a truly predictive model.

A follow on study termed "Fighter II" attempted to develop a predictive model based on the findings of Fighter I. There was no war on at the time, so artificial stress situations were created based on the premise that war was an extreme form of stress. From Fighter I, a test instrument called the Interest, Opinion Questionnaire (IOQ) was developed based on questionnaire items that best differentiated between fighters and non-fighters. The men were tested with the IOQ as well as with many of the scales and instruments used in Fighter I. In addition, the men were subjected to six stress situations, and their performances judged. The results are shown on Table V.

TABLE V

CORRELATION OF IOQ SCORES WITH
PERFORMANCE IN STRESS SITUATIONS

Stress Situation	Correlation With IOQ	Sample Size
Combat-in-Cities	-.14	109
Jump Tower	.27	113
Perimeter Defense	-.28	80
Dark Room	.14	110
Shock-Arithmetic	-.06	114
Oil Fires	.05	110

Adapted from Meeland, T., Egbert, R. L., Miller, I., Field Stress: A Preliminary Study of Its Structure, Measurement and Relationship to Combat, U.S. Army Leadership Human Research Unit, p. 56, 1957.

The oil fire situation was considered by the men undergoing testing, the researchers and outside experts to be the most stressful situation. It was thought to be the most realistic and closest to war. However, scores were not predictive of performance in the oil fires situation. Whether the IOQ was a good predictor of combat performance remained unverified. It certainly was not a way of identifying good oil fire fighters [Ref. 24].

Three of the findings of Fighter I are of particular interest to the question of women in combat. These are the findings concerning masculinity, the "doer syndrome," and health and vitality. Due to the design of the study, particularly the fact that measurements were taken after combat rather than before, generalizations based on the findings must be made cautiously. However, the findings are indicative of possibly important characteristics of fighters.

Fighters, as defined in Appendix A, tended to have better health and vitality than non-fighters. This was partially deduced from physical measurements of the subjects. Fighters were one inch taller than non-fighters (statistical significance less than .01) and eight pounds heavier (statistical significance less than .05). Figures 2 and 3 show the relationship of male and female recruit measurements to those of fighters and non-fighters.[1] Fighters were not only different from non-fighters but also

[1]Data on recruit measurements taken from an unpublished report on Navy women after boot camp by the Naval Personnel Research and Development Center, 1976.

FIGURE 2

COMPARATIVE WEIGHTS

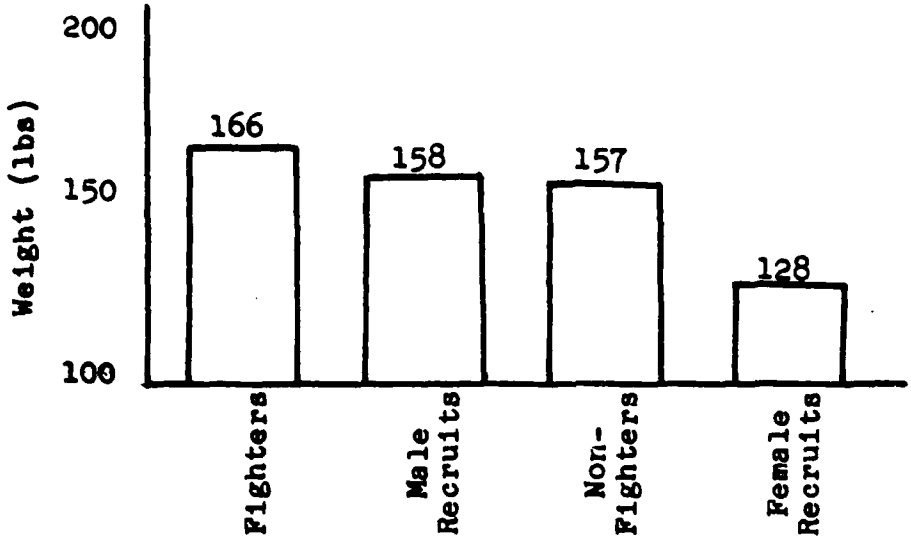
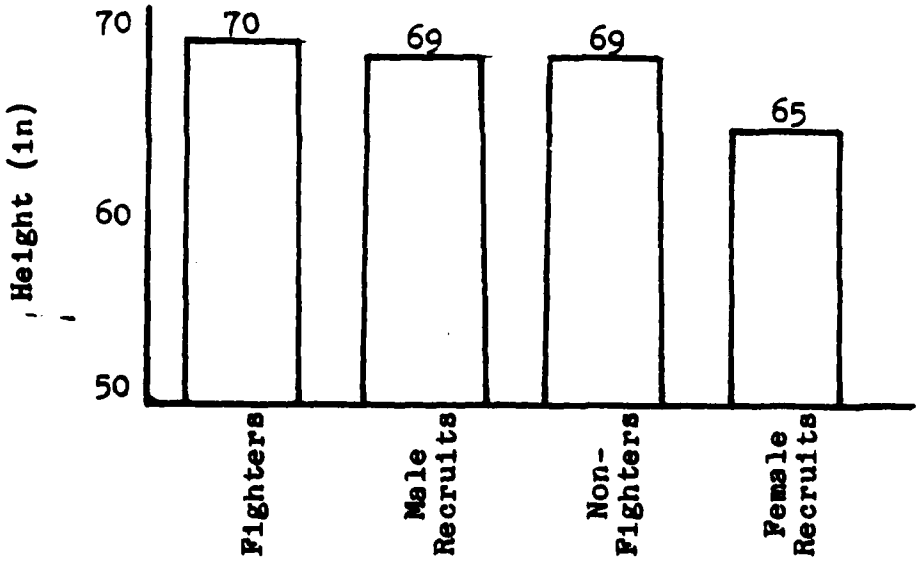


FIGURE 3

COMPARATIVE HEIGHTS



different from a normal population of male recruits. The mean height and weight for women are far below those for men. If, as the research suggests, physical measurements are connected with combat performance, then women would be at a decided disadvantage.

Fighters were also more masculine than non-fighters. Masculinity, as measured by masculine interests scores on the Strong Vocational Blank (SVIB), was significantly higher.[2] Also femininity[3] as measured by the Minnesota Multiphasic Personality Inventory (MMPI) and the California Personality Inventory (CPI) was significantly lower. Unfortunately, the researchers did not compare the data with scores from other populations, e.g., from civilians of comparable ages. (See Appendix B for a brief description of the MMPI and the CPI.) In a purely qualitative sense, however, the difference in raw score means was noteable. The differences between the mean scores for fighters and non-fighters on all three tests were significant (at less than .001), and the non-fighters' means were all in the more feminine direction.

Masculinity-femininity (M-F) scales are derived using only those questionnaire items which best differentiate men and women.

---

[2]The Masculinity-Femininity scales of the SVIB measure masculine interests and feminine interests. For example, masculine interests include outdoor occupations (e.g., rancher, forester) require mechanical aptitude (e.g., engineer, auto mechanic) or are physically strenuous (e.g., construction worker).

[3]Femininity as measured by the MMPI and CPI tend to measure cultural differences in the way boys are raised as compared to girls. For example, women tend to express greater fear of burglers than do men. Presented with the following item and asked to circle the word that seems most natural in comparison, men would more frequently circle gun or explosion and women would more frequently circle rouge or face: "Powder: Face, Explosion, Rouge, Gun."

All M-F scales tend to greatly exaggerate sex differences by design. Perhaps the most widely known M-F scale is the one designed by Terman and Miles [Ref. 25]. In order to compare the scores in the Fighter study with another population, it was necessary to rescale the Fighter data. A common mean and standard deviation was determined for each of the separate scales weighted for the number of fighters and non-fighters. The scores were then standardized to a mean of 52 and a standard deviation of 50 to correxpond with the Terman and Miles scale. The numerical results are shown in Table VI.

TABLE VI

RESCALED M-F SCORES

	Mean Scores			Rescaled Mean Scores	
	Fighters	Non-Fighters	Common Mean Scores	Fighters	Non-Fighters
CPI Fem.	16.17	18.02	16.79	60.96	34.22[4]
MMPI Fem.	5.45	6.57	5.83	61.50	33.50
SVIB Fem.	50.84	46.84	49.49	61.45	33.44

N = 130 Fighters
N = 66 Non-Fighters

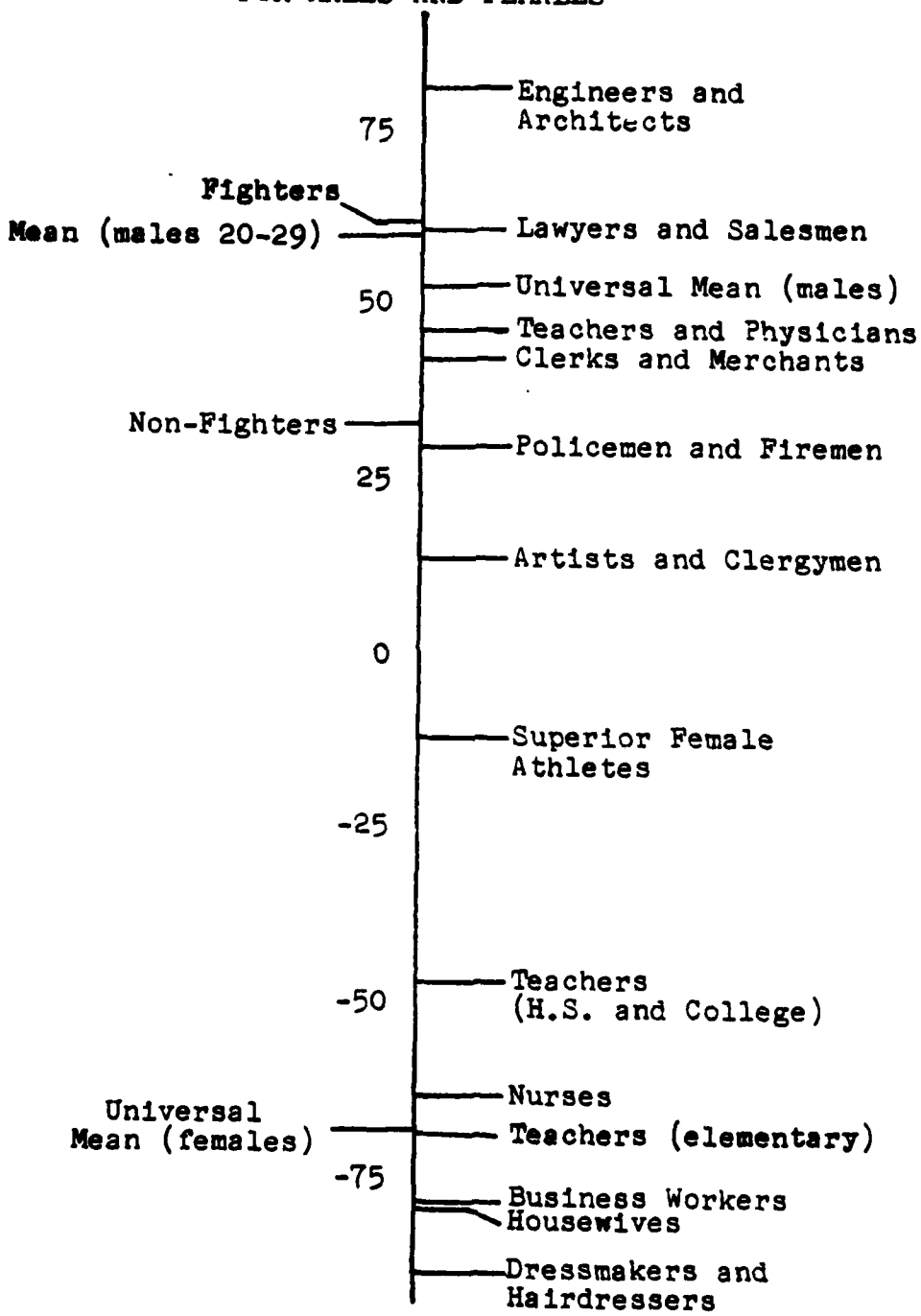
The results were superimposed on the Terman and Miles scale. The results are shown in Figure 4.

Figure 4 provides a graphic illustration of the degree of separation between men and women that is possible using carefully selected questionnaire items. Since M-F scales are designed to

[4]For the MMPI and SVIB femininity scales, higher scores indicated higher femininity. Thus, it was necessary to reverse those scales.

FIGURE 4

M-F SCALES OF OCCUPATIONAL GROUPS
FOR MALES AND FEMALES



Adapted from Terman, L. M., Miles, C. C., Sex and Personality, p. 160 and 181, Russell and Russell, 1936.

differentiate between men and women, women generally would score differently from men on similar scales constructed from the MMPI, CPI, and SVIB. Scores of women on such scales were not available for comparison. Thus, it was necessary to resort to the estimates depicted in Figure 4.

Unfortunately, no truly predictive model for fighters exists, and the likelihood of developing one based on combat experience is slim. The process of developing tests capable of predicting combat behavior would be a long and involved process, and would have a low probability of success. First, a task analysis is required in order to determine what measurable qualities are required for the job (ground combat). Then, suitable instruments must be selected or developed. Next, the instruments would be administered and the results matched against a criterion of success or failure for the subjects. Those test instruments which do not predict well would be modified or dropped. Finally, the revised instruments would be re-administered to a new group of subjects to validate the results and eliminate possible spurious correlations.

The first two steps in developing a fighter aptitude test have been taken by the Fighter studies. The data gathered on the combat survivors were, in effect, directed at determining attributes required of fighters. Also, an experimental test instrument was developed to attempt to identify fighters. However, in order to be proven predictive, the IOQ would have to be administered <u>prior</u> to combat. Trained psychologists would then interrogate combat survivors to determine who had met the fighter criterion and who had failed. It is possible that some of the

subjects would become fatalities before a determination could be made as to their combat effectiveness. Obviously, a war would be required first, and nations do not go to war in order to gather data.

Further, field tests that artificially induce stress do not seem to be effective in predicting fighters and non-fighters. In "A Review of Fighter I-VI" [Ref. 26], the author stated that the crucial situation in combat seemed to be the requirement for action in the constant face of death. Men will attempt tasks in training situations or in field experiments when they feel that adequate steps have been taken to ensure their safety, but the same tasks may not be attempted if in doing so the threat of death increases. The problem of research in this area, then, is getting men to risk their lives, or think they are, in accomplishing some task in a training environment. Clearly, this is not feasible in today's society, although similar experiments were done at one time [Ref. 27].

The review of the fighter research mentioned above described a theory about combat fighters in terms of activity of the individual soldier. A person who has developed a strong sense of security and confidence in his ability and has spread this ability over a wide variety of activities should do better in combat. In other words, if a person has already engaged in and mastered a variety of risk situations such as boxing, mountaineering, flying, scuba diving and the like, he would have strong confidence in his ability to control his surroundings even when faced with death.

The "doer syndrome" was perhaps the most significant finding of the Fighter I study in relation to the question of women in combat. The fighters had participated in more activities, hobbies and sports than had non-fighters (19 activities as compared to 15). They tended to prefer body contact sports and had participated in them longer and more frequently than had non-fighters. The activities that fighters participated in included gardening, racing, swimming, horseback riding, repairing automobiles and carpentry. Non-fighters participated in painting, cartooning and writing significantly more often than fighters.

Julia Fields commented in, "On the Psychology of Women: A Survey of Empirical Studies," [Ref. 28] that, on the average, females are less physically active than males from birth onwards. She also commented that males have a greater preference for outdoor activity, are more prone to risk taking and greatly excel women in athletic ability. The differences she speaks of are more or less small differences in means, with a great degree of distribution overlap, except in athletic ability. Maccoby and Jacklin [Ref. 11] conclude that men are more interested in competitive sports than women. Tyler [Ref. 29] refers to large sex differences in several areas including participation and interest in physically strenuous, adventuresome activities. There appears to be little doubt that, on average, males are more active, and participate in sports and other physically strenuous activities to a greater degree than do women. Thus, one of the more prominant differences between men and women is also one of the biggest differences between fighters and

non-fighters. Out of all the factors that were found to differentiate fighters from non-fighters, three also differentiated between men and women. Those three were: measurements of physical size, masculinity, and the "doer syndrome."

Although there were some difficulties with the Fighter series of studies, there did seem to be a very strong connection between adequate combat performance and stereotypic male interests and temperament. The nature of the data collection did not allow for establishment of a casual relationship between masculinity and combat performance, nor did it allow for development of a predictive model. However, the connection shown in the Fighter I study between masculinity and combat behavior is too great to be ignored: on average, and at this time in our culture, women resemble non-fighters much more strongly than they resemble fighters.

IV. SOCIAL STRUCTURE OF INFANTRY UNITS

A. BACKGROUND

From antiquity until after the American Civil War, men fought relatively close to one another. Even during World War I, average troop density was 464 men per square kilometer. Increasing firepower made frontal assaults by massed infantry suicidal -- as World War I demonstrated. By World War II, troop density had dropped to 33 men per square kilometer (refer to Table II) and men were taught to take full advantage of cover and concealment. It was in this context that Marshall discovered two phenomenon of infantry combat other than those previously discussed. First, relatively light fire coming against an advancing infantry unit often served to stall the advance for longer than necessary. He observed that men under fire scattered and went to ground losing sight of each other. Each man found himself totally alone and without support. Unit leaders found themselves out of touch with their men. Once the momentum of the advance was lost, extraordinary measures were often required to renew it. Second, Marshall observed that if men in the unit were strangers to one another, they would not stand and fight. If an enemy breakthrough was imminent and headquarters personnel, such as cooks and drivers, were pressed into service, they would drift away while being led towards the fight. Those personnel that made it to the front line would often be worthless in the action. Effectiveness in infantry combat seemed to be very strongly determined by unit cohesiveness [Ref. 2].

The explanation for this behavior seemed to be related to the strength of the primary groups that were formed by the men in the units involved. A primary group is a small group of individuals characterized by intimate, frequent, face-to-face interactions. Four other features differentiate a "group" from a collection of individuals. These are a common set of goals or motives, a set of norms, a set of roles and a network of interpersonal attractions [Ref. 30]. A member of a primary group feels himself bound very strongly by the established norms. At the same time, the member of a primary group develops strong affections for one or more of the members and is thereby tied into the common fate of the group.

Since World War II, the importance of unit cohesiveness has been well established in the literature (see Ref. 31, p. 243 for a list of nine titles and authors through 1970). Charles Moskos observed several U.S. Army squads in 1965 and again in 1967 in Vietnam. He reported that the concept of primary groups had limitations in explaining combat performance. The soldiers participated in the primary group structure out of necessity. The overriding motivation was for personal survival and participation in the primary group was limited to just what was required for survival. The soldier's view of the war was intensely individualistic, heightened perhaps by the one year rotation policy. An individual's war was over when he rotated. Moskos did not deny the existence of primary groups, merely reinterpreting them as due to "enlightened self-interest" rather than to a "mystical bond" [Ref. 31].

Gabriel and Savage, on the other hand, claimed that the one year rotational policy and a lower quality of leadership, virtually destroyed the primary group structure of the Army in Vietnam. The absence of primary group structure explained widespread drug abuse among soldiers, as well as combat refusals and "fragging" [Ref. 32].

B. THE WERMACHT IN WORLD WAR II[5]

Perhaps the best illustration of the power of primary groups was the strength of the Wermacht in World War II.

> "Although distinctly outnumbered and in a strategic sense quantitatively inferior in equipment, the German Army, on all fronts, maintained a high degree of organizational integrity and fighting effectiveness through a series of almost unbroken retreats over a period of several years." [Ref. 35]

This quote was from an article written on the Wermacht by Edward Shils and Morris Janowitz shortly after World War II. The superiority of the German Army during WW II was widely recognized, and Dupuy attributed this superiority to the German staff system [Ref. 3]. Shils and Janowitz, however, contended that the superiority of the Wermacht was largely due to strong primary groups fostered by the Wermacht. These primary groups were characterized by their small size (rarely larger than squad size) and the intimate, warm atmosphere shared by the group members.

The ability of the individual to prevail in battle was due to the strong social fabric of his primary group. The Wermacht high command encouraged the formation of strong, interdependent

---

[5]This section draws heavily from the work of Shils and Janowitz [Ref. 33].

primary groups by keeping units together as much as possible. When a division was worn down from combat losses, it was withdrawn as a unit from the front. Combat losses were replaced and the unit retrained, thus giving the soldiers time to again form primary groups. This was in contrast to the U.S. Army policy of keeping divisions on line and feeding replacements in piecemeal [Ref. 34]. As long as the Wermacht was successful in maintaining these strong primary groups, the German Army fought with extraordinary tenacity in spite of catastrophic defeats. When primary groups were broken by loss of leaders, major breaks in the supply chain or severe casualties, disaffection quickly followed and the will to resist evaporated. The German Army resisted effectively until almost the very end of WW II and for the most part had to be overrun and destroyed in detail.

Wermacht units with strong primary groups suffered very little from desertion or spontaneous surrender. German soldiers from such units spoke very highly of the degree of comradliness of the units and often described them as "one big, happy family." The few deserters from those units with strong primary groups were characterized chiefly by their failure to be absorbed into the primary group structure of the Wermacht. The vast majority of deserters captured during the early phases of the war came from units composed of "Volksdeutsch" (individuals of German heritage residing outside German boundaries), as well as Austrians, Poles, Yugoslavs and Russians coerced into service. The "Volksturm" units, composed of boys, old men and older married men, were among the most worthless German units during the latter

stages of the war. The most obvious common element of all these less effective units was the lack of primary group formation within the units. This was due to factors present in the units which prevented the formation of primary groups, such as, lack of a common language, bitterness over coersion and failure to break previous primary group memberships of family and community in the case of the Volksturm. Spontaneous mass desertions and surrender were much more common in these units than in the regular Wermacht. Towards the very end of the war, makeshift units were hurriedly thrown together from new recruits, stragglers, airforce men, sailors and concentration camp inmates. These units quickly disintegrated in the heat of battle. This was in direct contrast to regular Wermacht divisions. These divisions, even very late in the war, had to be defeated in detail to be rendered ineffective. Where primary groups were strong, the units resisted, where primary groups were weak or non-existent, the units generally failed in combat.

Shils and Janowitz [Ref. 33] also reported several contributing factors to primary group solidarity in the Wermacht. These factors were the quality of leadership, the presence of a "hardcore" nucleus within each group, and the German concept of "soldierly honor." The junior officers and NCO's were a highly select group of individuals. The officers were trained to treat their men with a combination of sternness and fatherly benevolence. They held their men in high esteem. The enlisted men reciprocated this esteem and German infantrymen frequently praised the conduct of their officers and NCO's. The job of the leaders was made easier

by the presence of a "hardcore" among the enlisted ranks. This "hardcore" comprised about 10 to 15 percent of the lower enlisted ranks. They were men who had grown up and participated in the best phases of the rebuilding of Germany under National Socialism and had a deep sense of community solidarity and placed a high value on "toughness" and "manly comradliness." The "hardcore" served as models to the less enthusiastic men and were instrumental in developing and maintaining group solidarity. Finally, German society considered military life as a privilege in contrast to the British and American's concept that military service was a disagreeable necessity.

Factors that served to weaken Wermacht primary groups, according to Shils and Janowitz, were the physical isolation of individuals or fragments of groups, the family ties of the soldiers, and the demand for individual survival. Prolonged isolation increased the frequency of surrender. Individuals isolated by tactical situations and fearing destruction, surrendered much more readily than those individuals bound by the norms and physical ties of their primary groups. Towards the end of the war, desertion was more likely by individuals who returned home on leave. This was a consequence of loss of personal contact with the Army primary group, a renewal of the family primary group bonds and the increasing likelihood of personal destruction upon return to the Army. The threat of death was the most persistent way that weakening of the primary groups occurred. However, it was only under the most severe conditions of deprivation or hopelessness that dissolution of

primary groups occurred. Under most circumstances, the presence of the primary group seemed sufficient to ensure that the average German soldier would stand his ground and resist.

The Wermacht, in WW II, was favored by a number of factors that enhanced primary group solidarity. When group structure was shattered or not allowed to develop, a severe degradation of effectiveness ensued. The observations of Shils and Janowitz on the Wermacht agreed with those of Marshall on the U.S. Army. The reason a man stands and fights in combat is because of the affection and support of his close comrades.

C. THE U.S. ARMY

1. Background

Whereas primary group solidarity has been established as central to the success of the Wermacht in WW II, research results for U.S. forces have not been as clear. Marshall established the necessity that men in a unit know each other and rely on each other [Ref. 2]. Little emphasized the importance of the "buddy relationship" in the Korean War [Ref. 34]. Clark found that squads in Korea varied in the amount of social cohesion present, but none seemed to display deep interpersonal relations [Ref. 35]. Finally, in Vietnam Moskos determined that personal survival was paramount and group ties secondary [Ref. 31]. In no case, have researchers discovered in U.S. forces the deep, affectionate ties that seemed to characterize the Wermacht primary groups.

2. Rifle Squads in Korea

In 1952 and 1953, a research team from the Human Resources Research Office studied sixty-nine squads on the Korean front line

[Ref. 35]. Their purpose was to discover what factors accounted for differences in effective and ineffective squads. The team gathered data on individual squad members and also case histories on the day-to-day activities of the squads. They discovered five leadership characteristics that seemed to be important to effective functioning of squads. They also discovered how difficult differentiating an effective squad from an ineffective squad was.

In order to differentiate squads, the team asked platoon commanders for effectiveness ratings. This method was not entirely satisfactory since platoon commanders often did not have detailed information on squad effectiveness. The team also requested information from squad members on the effectiveness of their own squad. This method was not entirely satisfactory either, and the research team finally settled on a combination of both types of effectiveness rating data. An operational definition of effectiveness based on "success in a combat action" was evidently not possible. This may have been due to the static nature of the warfare at the time. (The only combat action was patrolling and patrols were made up of volunteers drawn from several squads.)

From the case histories of the squads, five leadership functions were isolated:

Managing - formal functions which the squad leader was held accountable for through the chain of command, such as distribution of supplies and communication of orders

Defining - verbalizing acceptable behavior

Modeling - demonstrating expected behavior

Teaching - demonstrating or verbalizing a special skill

Sustaining - providing emotional support to squad members

The number of functions displayed by each squad varied. One member of virtually all squads was managing. In most squads, somebody performed the defining function. However, the functions of modeling, teaching and sustaining were more sporadic (see Table VII).

TABLE VII

NUMBER OF SQUADS PERFORMING LEADERSHIP FUNCTIONS

Function	No. Were	No. Were Not
Managing	67	2
Defining	52	17
Modeling	26	43
Teaching	26	43
Sustaining	24	45

Clark, R. A., Leadership in Rifle Squads on Korean Front Lines, U.S. Army Leadership Human Research Unit, p. 23, 1955.

Other squad members besides squad leaders were found to be performing leadership functions. In the 69 squads, 66 squad leaders, 49 assistant squad leaders and 35 other squad members were found to be performing one or more functions. Effectiveness was not influenced by the position of the person who performed the leadership function, but by whether the function was being performed at all. Leadership was defined as consistent behavior by one of the squad members that fell into one of the five leadership categories. Thus, more than one leader was found in many squads.

An attempt was made to assess squad cohesiveness by determining interpersonal choices. Squad members were asked to choose three platoon members most preferred and three platoon members least preferred based on five criteria, e.g., as a bunker mate, have alongside in a firefight.

The results were clearly disappointing. Almost all squads were split into an "in group" and an "out group". Typically, four members were in the out group and five members were in the in group. Approximately one-third of the most preferred/least preferred choices were made toward individuals outside the squad. However, squad leaders in 39 out of 69 squads were chosen as "most preferred" more often than the average squad member. From this, the researchers concluded that, on the average, squad leaders were members of the squads' primary groups. They further concluded that each squad fit the definition of primary group, but was not, in general, very cohesive as judged by interpersonal choices.

Squad combat aggressiveness was determined by the presence, in the squad, of a common desire to be aggressive in combat. If each squad member expressed a desire for the squad to do something or be something, verbalized a sense of responsibility to accomplish the goal, and could point to specific evidence that the group was working toward accomplishing the goal, then the squad was said to have a group goal. If, in addition, the goal was to "seek out and destroy the enemy," then the group was said to possess a high degree of combat aggressiveness. Twenty-one squads had this characteristic (see Table VIII).

TABLE VIII

21 SQUADS WITH COMBAT AGGRESSIVENESS AGAINST
48 SQUADS LACKING COMBAT AGGRESSIVENESS

Leadership Function	Number With	Number Without	Percent With	Percent Without	Diff.	Sig.
Managing	20	47	.95	.98	-.03	*
Defining	18	34	.86	.71	.15	NS
Modeling	18	8	.86	.17	.69	.001
Teaching	12	14	.57	.29	.28	.03
Sustaining	13	11	.62	.23	.39	.002

* t-test of differences not appropriate

Clark, R. A., Leadership in Rifle Squads on Korean Front Lines, U.S. Army Leadership Human Research Unit, p. 38, 1955.

Modeling, teaching and sustaining type of leadership functions appeared to be important determinants of combat aggression. Unfortunately, combat aggression, in this study, was defined by consensus of squad members and the validity of the term is somewhat suspect. However, the presence of a common group goal may have been important evidence of group cohesion. Clark appears to have overlooked that fact.

More recent research has indicated that, although affective ties are important to primary groups, they are not necessarily measured by the amount of "liking" that exists between group members. According to Dunphy [Ref. 36], the strength of the group ties are determined by the existence of a basic agreement of who is liked and who is disliked and also by who has power and who does not. Cohesive primary groups are further characterized by a strong sense of integration which maximizes

group cooperation and minimizes conflict. The extent to which integration is present in a group is measured by the extent to which group goals are similarly ranked. Finally, cohesive groups agree on who, outside the group, is liked and who is disliked. There is also a consensus on ideas that are liked and disliked. Dunphy emphasized the crucial role that primary groups play in the military and stated that an army in battle is the prototype of the primary group under stress.

Although Clark failed to detect strong, cohesive primary groups among the squads in Korea, it was evident from the research report that most of the squads were, to some extent, cohesive, and many of the squads were, in fact, strongly cohesive by Dunphy's criteria, e.g., consensus of squad status and common group goals. For example, each of the nine-man squads had two Korean soldiers as members. The two Koreans in each squad were almost universally in an out group. In only one squad was this not true. Almost all squads had at least one member who was disliked by all other squad members. Further, men with actual combat experience held positions of high status. Finally, the presence in 21 squads of a desire to "seek out and destroy the enemy" was strong evidence, not only of cohesive squads, but also of squads with goals parallel to those of the U.S. Army.

The presence of "combat aggressiveness" was primarily an indicator of squad cohesiveness rather than combat proficiency. However, the Fighter I study, presented earlier, did link actual combat proficiency of individuals with the degree to which they identified with their units (see Table IX).

TABLE IX

IDENTIFICATION WITH COMBAT UNIT

Degree of Identification	% Fighters	% Non-Fighters	Significance of Difference
High	62	38	.01
Above Average	27	31	NS
Below Average	7	22	.05
Low	4	6	NS
Not Rated	0	3	NS

Egbert, R. L. and others, Fighter I: An Analysis of Combat Fighters and Non-Fighters, Human Resources Research Office, p. 39, 1957.

Fighters tended to identify highly with their units more frequently than did non-fighters. The data suggest that fighters tend to come from more cohesive units if "identity with unit" could be used as a measure of cohesiveness.[6] The link between unit cohesiveness and fighters' personal characteristics was missing from the Fighter I study, however.

The U.S. Army in the Korean War did not foster primary group structure with its doctrine. A one year rotation policy was detrimental to unit cohesiveness. The policy of making up patrols from volunteers certainly did not help squad cohesion. Further, placing two Korean soldiers in each American squad was not helpful. Clark determined that the Koreans were almost always in an out group. Marshall observed that Korean members of American squads were generally not effective [Ref. 17].

[6]It may be that cohesive units lead to fighting behavior by squad members, and/or that having squad members who are fighters produces cohesive units.

However, Korean soldiers fighting with the Republic of Korea Army often fought well and inflicted heavy casualties on their enemies [Ref. 39]. It is probably safe to say that primary groups formed among U.S. squads in spite of Army policy; the extent to which primary groups were present was not as high as could have been possible.

3. The Role of the Military Primary Group

Cohesive primary groups are necessary to the prosecution of a war, but they are not sufficient. For maximum effectiveness, the primary groups must actively espouse the goals of the larger organization. This was the case for the 21 squads with combat aggression in the Clark study. The key position in a squad is the appointed squad leader. He must be a member of the primary group, yet represent the demands of the Army. However, other functions are required in order for the squad to develop cohesiveness. Functions such as modeling or teaching may be performed by other members of a squad. In this way, a number of primary groups may be welded into an army. The Wermacht not only had highly cohesive primary groups, it had primary groups which actively supported Wermacht goals.

The problem faced by the U.S. Army during the latter stages of the Vietnam war may have been the result of oppositional primary groups. Faris concluded that "fragging" could be viewed as group action against troublesome superiors, e.g., superiors who tried to enforce drug regulations or who sought excessive combat action. Faris also suggested that mutiny was an obvious

small group phenomenon [Ref. 38]. Thus, in Vietnam, the Army may have been weakened by primary groups which actively opposed its goals.

An army in combat requires primary groups with goals similar to those of itself. Men do not seem to fight without the support of their primary group. An army will not function properly without the support of its primary groups.

D. WOMEN AND PRIMARY GROUPS

Research on military primary groups under the stress of combat has been performed with all-male units. Introducing women into this all-male domain will also introduce a large measure of uncertainty about combat performance of small units. This is for two reasons. First, research on gender-integrated units under the stress of combat is not generally available. Second, the principal stress in combat is the prolonged exposure to the threat of death. The simulation of this intense stress in field experiments is not feasible.

However, research on women in the civilian labor market has been done. Oppenheimer reviewed the literature on integrated work groups and concluded that, in general, men and women compete in separate job markets. Mixed work groups were not common. The introduction of one or two females into a male work group involved excessive adaptation to the presence of females. If enough women were introduced so the sex ratio was approximately equal, then the work group tended to split into two, possibly hostile groups, along sexual lines [Ref. 39].

In a second review comparing men and women as leaders, Hollander and Yoder proposed that, in small groups, the effectiveness of female leaders depended on leadership role and style, as well as on situational characteristics. Generally, the role of leader is expected to be filled by a man. Thus, a woman might find herself handicapped by having first to prove herself as a leader before performing her job as leader effectively. Both men and women expect leaders to be men. Women were much less likely to emerge as leaders in gender integrated groups. Leadership styles were a second important determinant of effective female leadership. Holland and Yoder found that researchers generally agreed that women had a greater concern for interpersonal relations than did men. Men tended to focus on task accomplishment or individual performance. Finally, situational influences were also considered important to effectiveness. Sex composition was one of these important situational influences. Group performance and group harmony were affected by whether the group was integrated or segregated, and by whether the leader was male or female. Also, sex typing of task performance was another important factor since success or failure of a leader and subsequent evaluation by group members tended to focus on whether the task presented was stereotypically masculine or feminine [Ref. 40].

Other factors are important to the fate of women in organizations. Bartol proposed that upwardly mobile women are filtered out of the promotional structure of organizations at various career stages and, thus, do not become successful top level

managers [Ref. 41]. Kanter concluded that a single woman in an all-male organization is at a decided disadvantage due to tokenism. The token woman is always in the limelight where sex differences are accentuated [Refs. 42, 43]. While it is generally accepted that men and women are equal in many achievement-related characteristics such as intelligence and motivation, there is strong evidence that women tend to minimize their successes and emphasize their failures. That is, women are far more likely to take personal responsibility for failure and far less likely to take responsibility for success on a given task. This was found to be especially true when women worked with men [Ref. 44]. In reviewing leadership styles, Tavris and Offir found that women were more likely than men to use indirect methods such as emotional pleas or suggestions rather than authority to get their way in group or leadership situation [Ref. 45].

From the literature reviewed, it appears that if women were to be included in infantry units, they would have a substantial impact. The importance of primary groups to infantry units was established by Shils and Janowitz [Ref. 32], as well as by other researchers [Refs. 2, 31, 34, 35 and 36]. Introducing women into rifle squads may be disruptive to primary group solidarity. On the other hand, women may prove beneficial. Clark [Ref. 35] found that a higher percentage of combat effective squads had one or more members who provided emotional support as compared with squads without combat aggression (refer to Table VIII). Since women are generally concerned with interpersonal relations in group action [Ref. 40], more than are men, they may provide

an influence increasing unit cohesiveness. This may be offset, however, by the greater reluctance women have in assuming informal leadership roles [Ref. 40]. It may also be offset by the greater reluctance with which group members accept women leaders [Ref. 40].

It is possible that some gender-integrated squads will be cohesive, effective combat units. On the other hand, some gender-integrated squads may fall apart under the stress of combat when all-male squads would have not.

V. A STUDY OF JUDGMENTS CONCERNING APPROPRIATE JOBS FOR WOMEN

A. BACKGROUND

The preceding chapters have reviewed the literature concerning the individual and group variables influencing the performance of ground combat units. It has been concluded that certain of those variables have been identified as important correlates of unit combat performance. Some possible unit performance implications of gender-integrated units have also been identified, but predictions regarding the combat effectiveness of gender-integrated units cannot be made with confidence.

Before the United States decised to field gender-integrated ground combat units, military policymakers, Congress, the Executive, the Judiciary, and the American public will have had to move to support the use of women in ground combat roles. Thus, it becomes important to examine how individuals make judgments concerning whether or not a job can be appropriately filled by a woman. For instance, it seems likely that most individuals would judge secretarial and nursing jobs as being appropriate for women; but jobs such as stevedore and machinegunner would be judged as inappropriate for women. This chapter presents the results of a study of perceptions concerning the appropriateness of different jobs for women. Basic descriptive statistics summarizing the perceptions will be shown, and the results of multidimensional scaling and cluster analyses of the perceptions displayed.

A questionnaire was developed which contained 51 civilian and military occupations to be rated on a scale from 1 to 7 with 1 as ideally suited to women and 7 as totally unsuitable. (See Appendix C.) The occupations were selected on the basis of several criteria which might be used to judge whether an occupation was suitable or unsuitable. These criteria were traditional/untraditional jobs, life taking/life saving jobs, heavy labor/light labor jobs, dangerous/safe jobs and dirty/clean jobs.

The questionnaire was administered to 62 U.S. military officer graduate students at the Naval Postgraduate School in May of 1979. Five of the respondents were female officers. Seven questionnaires were deleted since the respondents selected one number for all occupations. The method used to scale the data would not accept such responses. Three of the seven questionnaires that were deleted were from females. The final sample was 55 graduate students, of whom two were females. Table X contains the mean and variance of the ratings for all 51 occupations from the 55 subjects.

B. MULTIDIMENSIONAL SCALING

1. Background

The first technique used to analyze the data was multidimensional scaling. This technique attempts to map a number of stimuli (in this case, jobs) into dimensions based on the similarity of the stimuli as first proposed by Kruskal [Ref. 46]. The purpose of multidimensional scaling is to discover any underlying geometric relationships between the points in as few dimensions as possible.

TABLE X

MEAN AND VARIANCE OF RATINGS ASSIGNED JOBS ON THE PERCEPTION QUESTIONNAIRE (N=55)*

No.	Mean	Variance	Occupation
1	1.8364	1.2411	Real estate agent
2	2.6909	1.4192	Undercover policeperson
3	2.1273	1.5114	High wire performer
4	2.3091	1.3496	Military radio repairperson
5	3.5818	1.8905	Helicopter crew chief
6	1.6545	1.0525	Social worker
7	1.8727	1.1501	Bookkeeper
8	3.5636	1.9714	Military truckdriver
9	2.0000	1.2166	Military dentist
10	3.8000	2.1659	Medic (Infantry)
11	3.4909	1.9924	Sewer repair worker
12	1.5636	0.9727	Nurse (MASH)
13	2.9455	1.8522	Stunt pilot
14	1.5818	1.2759	Housewife
15	3.0545	2.0207	Professional assassin
16	4.3818	2.3229	Squad leader (Infantry)
17	4.1091	2.0439	Garbage collector
18	3.5091	2.1863	Army chaplain
19	4.7455	2.2114	Lumberjack
20	4.4000	2.0427	Stevedore
21	3.9455	2.5811	Chief of Naval Operations
22	2.8727	1.8821	Gran Prix race driver
23	4.0909	2.1977	Steel mill foreman
24	2.4182	1.3174	Min. man missile crew member
25	2.6000	1.6628	Janitor
26	3.6182	1.9766	Tank mechanic
27	2.4545	1.6476	Used car salesperson
28	2.1273	1.4981	Spy (overseas)
29	2.1273	1.2183	Navy intelligence officer
30	3.4545	2.1418	F-15 pilot
31	2.0000	1.3115	Naturalist
32	2.1636	1.4984	Surgeon (MASH)
33	2.9636	1.9134	F-4 radar intercept officer
34	2.8909	1.6173	A-A missile crew member

TABLE X (CONTINUED)

No.	Mean	Variance	Occupation
35	4.3636	2.3276	Rifleperson
36	2.0909	1.4424	Bank manager
37	3.9273	2.1138	Sniper
38	3.8000	2.3603	Poseidon missile crew member
39	1.8000	0.9567	Military pay clerk
40	4.0545	2.0813	Artillery cannoneer
41	1.9091	1.4221	Student (NPS)
42	2.0182	1.3804	Surgeon (CONUS)
43	3.1818	1.9322	Riveter
44	4.2000	2.1511	Coal miner
45	4.0182	2.4721	Executive officer (DD)
46	1.4545	0.8497	Nurse (CONUS)
47	1.7273	1.1903	Sewing machine operator
48	4.1455	2.1981	Machine gunner
49	4.4000	2.4357	Company commander
50	2.6364	1.5135	Small arms repairperson
51	1.7091	1.0102	Secretary

*Judgments (ratings) were recorded on a rating scale on which 1 = Ideally suited for a woman and 7 = Totally unsuited for a woman. See Appendix C for a copy of the questionnaire.

The scaling technique requires a measure of distance between each pair of stimuli. The points are then arranged in an n-dimensional space, so that the original distances between pairs of points are satisfied as closely as possible. The degree to which the points cannot be arranged to satisfy all inter-pair distances is called "stress."

The KYST program used in this thesis used an upper triangular matrix with no diagonal elements as data input. Each pair of stimuli points j and k had a similarity measure (to be described in the next section) say, X_{jk}, $j<k$. The program derived an initial configuration in the dimensionality specified by the user. It then determined the Euclidean distance between each pair of points j and k and regressed this distance on the similarity data. The values of the regression were then used to calculate stress. The program then moved the points around in space according to a steepest descent, minimization algorithm in an attempt to reduce stress. When the program reached a local minimum, it terminated and printed the results.

2. Similarity/Dissimilarity Calculations

Similarity data required by the KYST program were calculated by the method suggested by Burton [Ref. 47]. Burton had subjects sort a deck of 60 cards, each with an occupational name on it, into piles such that each pile had occupations which the subject thought were similar. For the purposes of this thesis, each questionnaire item with the same scale rating was assumed to be similar in "suitability" for women. All items with the same rating were called a cell for each subject. Thus, the term

C_{ia} was used to denote the number of occupations in cell a for subject i. Then, the probability that any two items were in the same cell was $P_{ia} = (C_{ia})\ (C_{ia} - 1)\ /\ (51 \cdot 50)$. Also, the probability that any two items were in different cells was $Q_i = 1 - (P_{i1} + \cdots + P_{i7})$ as long as there were at least 2 cells in the subject's questionnaire.

If only a few occupations were in the same cell, then this cell contained high informational value as to the similarity of the occupations. In the same way, if two occupations were in different cells and the probability of their being in different cells was low (Q_i low), then this again has high informational value as to the dissimilarity of the pair. This informational value was captured by taking logarithms to the base two. Thus, the appropriate similarity/dissimilarity factor for each cell C_{jk} was:

$X_{jki} = -\log_2 P_{ia}$: j and k in the same cell C_{ia}

or $X_{jki} = \log_2 Q_i$: j and k in different cells

Since the size of a subject's cells was not, in general, the same, it was necessary to standardize the measurements using the normal distribution. Thus, mean m_i and variance s_i were calculated for each subject i:

$$m_i = -\sum_{a=1}^{7}(P_{ia}\log_2 P_{ia}) + Q_i \log_2 Q_i$$

$$s_i^2 = \sum_{a=1}^{7} P_{ia}(\log_2 P_{ia})^2 + Q_i(\log_2 Q_i)^2$$

Finally, the similarity/dissimilarity measurement for each pair of occupations j and k for subject i was:

$$Z_{jki} = (X_{jki} - m_i)/s_i$$

These were summed over i to get an upper triangular matrix such that each pair of occupations had a measure of similarity/dissimilarity. High positive values indicated extreme similarity and negative values indicated dissimilarities. The highest value was 57.68 for sewing machine operator and secretary. A transformation was made so that high similarities had the smallest value.

$$Y_{jk} = \left|Z_{jk}-60\right|$$

Thus, the transformed value was 2.32 for the sewing machine operator and secretary. Similarly, measurements were obtained for all 1275 pairs of occupations.

3. Results

Stress results for dimensions 1 through 6 are shown in Figure 5. Stress for 2 dimensions was .1771. Figure 6 contains the plots for two dimensions. The X axis seemed to be a measure of whether an occupation has been traditionally male or female. The most traditional male jobs were on the far right of the graph and the most traditional female jobs were on the far left. The meaning of the Y axis was not as clear, but it perhaps is a measure of prestige since most of the jobs above the X axis were more prestigeous than the jobs below the X axis. This was not wholly satisfactory, however, since medic was rated above surgeon as was used car salesman.[6]

---

[6] A stress value of .1771 is considered to be high and indicated that perhaps more dimensions were involved [Ref. 48]. However, an analysis of higher dimensions failed to reveal any obvious interpretation for the axes.

FIGURE 5

PLOT OF STRESS VERSUS DIMENSION

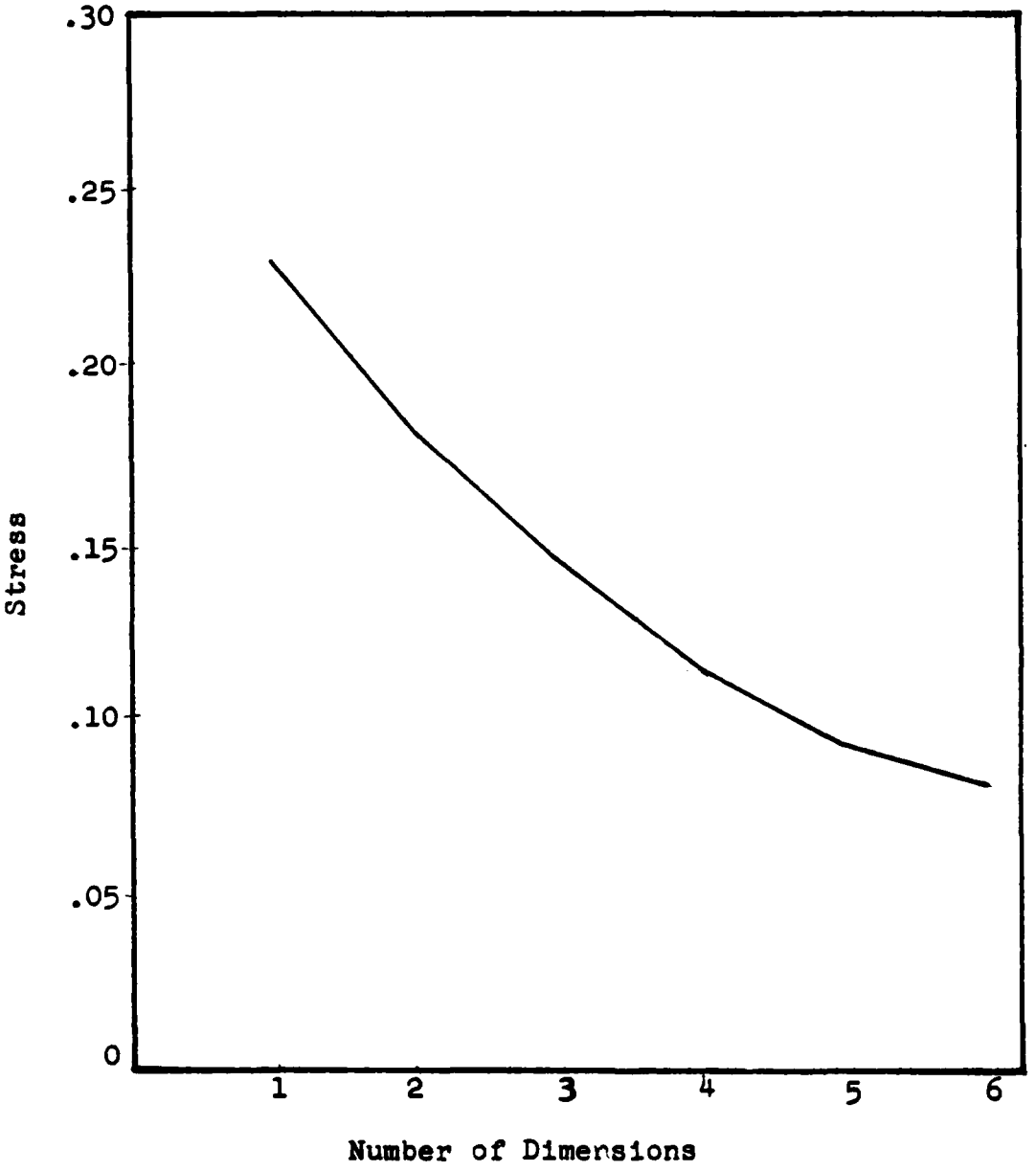
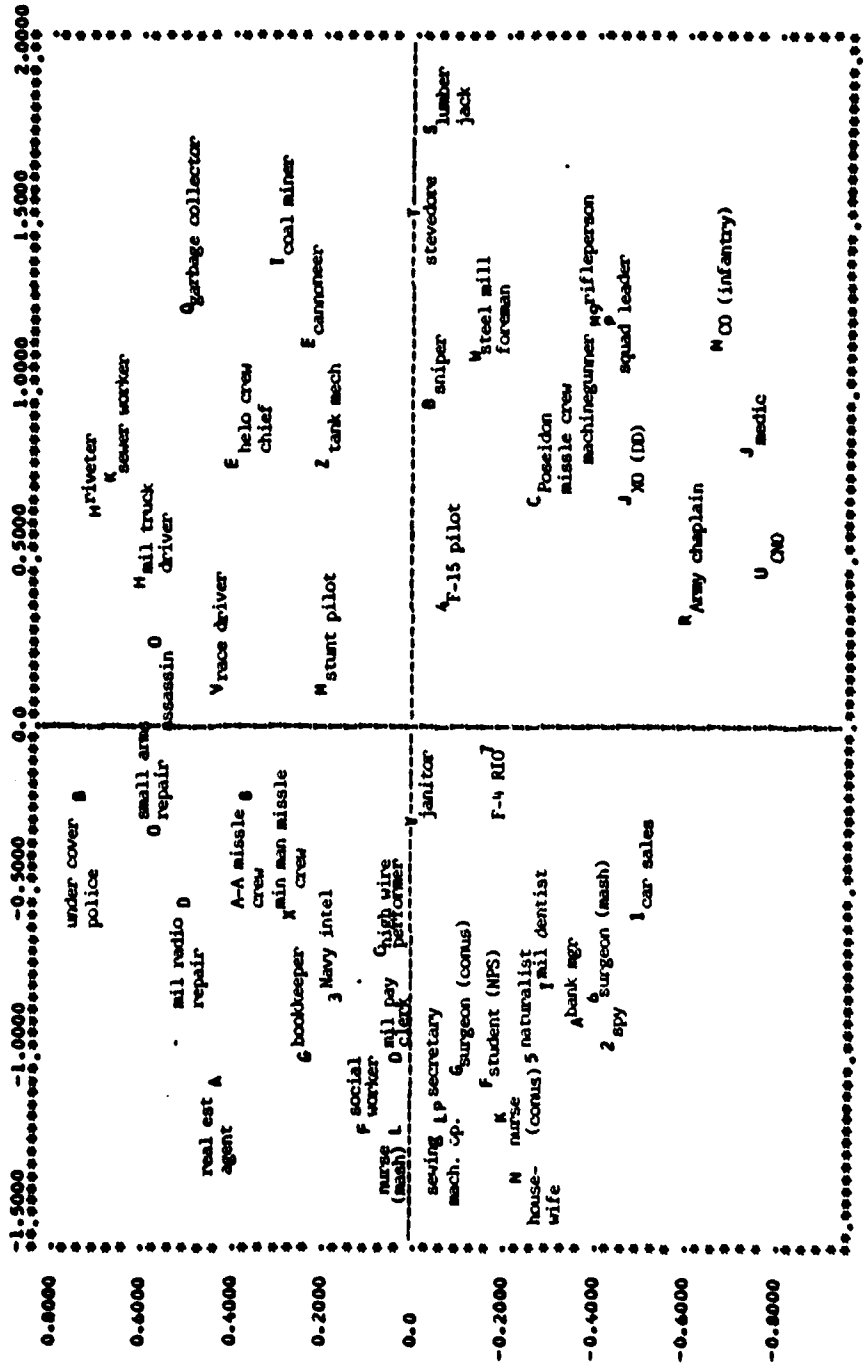


FIGURE 6

CONFIGURATION PLOT FOR 2 DIMENSIONS



Failure of the data to reveal more than a single dimension was possibly the results of the method of data collection. Subjects were asked to rate jobs on a scale from 1 to 7 as suitable or unsuitable. A more satisfactory result might have been attained had respondents been asked to sort cards, with a single occupation each, into piles that were equally suitable for women. Nevertheless, the data did seem to indicate that there was a strong element of tradition in the way jobs were judged as suitable or unsuitable for women.

C. CLUSTER ANALYSIS

1. Background

In an attempt to extract more information from the data, the technique of cluster analysis was applied. Like multidimensional scaling, cluster analysis attempts to discover structure within a large body of data [Ref. 49]. It attempts to divide the data into groups that have a high degree of "natural association." Clustering techniques require some measure of similarity or distance between each pair of points being clustered.

For this analysis, a hierarchical clustering method was used with the identical similarity matrix described in section B.2. above. The exact technique used was the single linkage method [Ref. 49]. First, the method starts with n clusters of one point each. It searches through the similarity matrix for the most similar pair of clusters. Then, the method merges the pair, thus reducing the number of clusters by one. It then updates the similarity matrix to reflect the revised similarities between the merge and all other clusters. It repeats this n-1

times so that only one cluster exists. In the single linkage method, distances between each cluster are determined by the distance between the two closest members of each cluster. Thus, at each iteration, two clusters are grouped together according to the distance between the two closest points that have not already been clustered [Ref. 49].

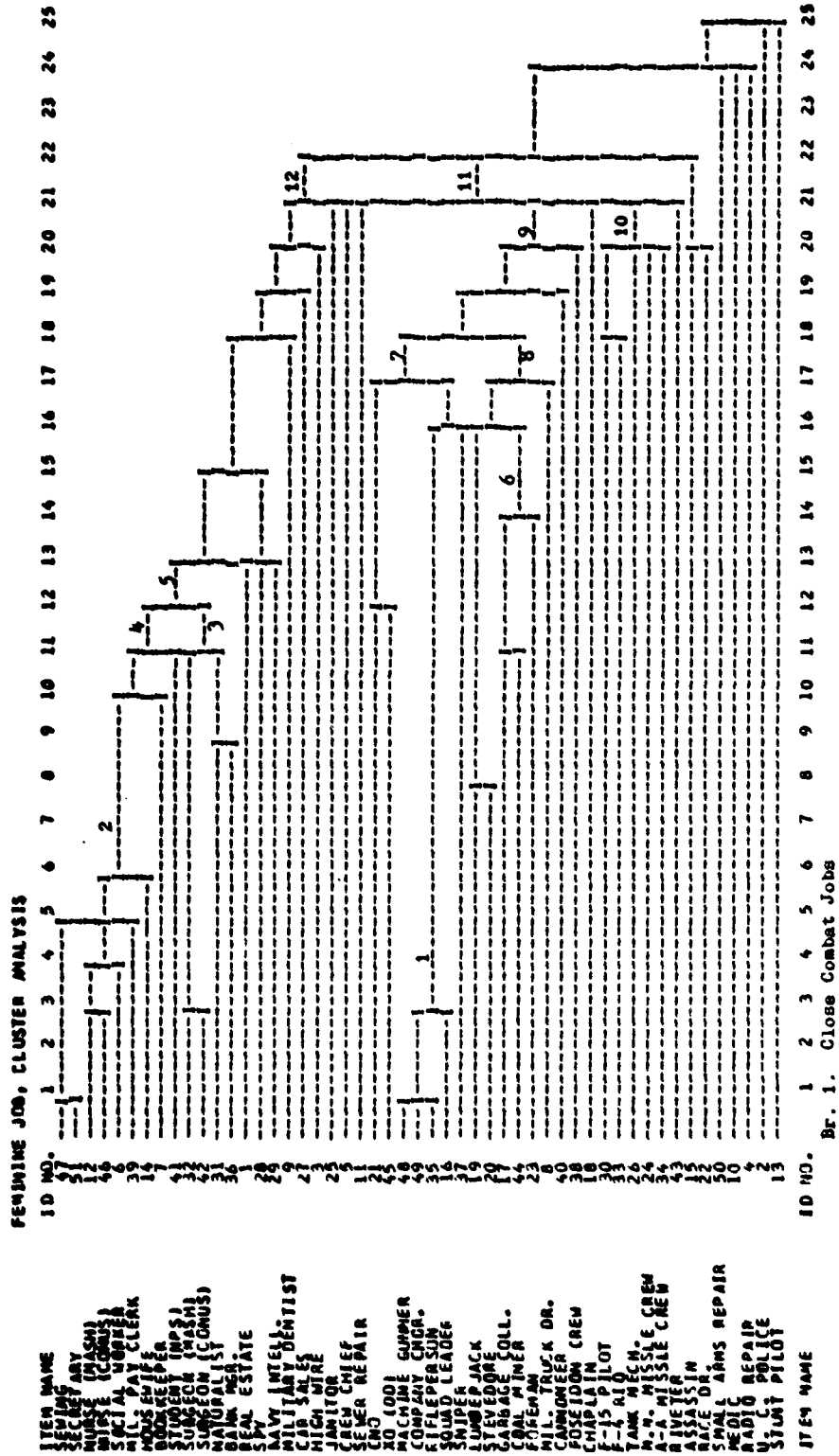
2. Results

The results were more interpretable than were the results for multidimensional scaling (see Figure 7). Items that were clustered together had a high degree of "natural association" for the most part. Due to the method of aggregating the raw data, occupations clustered first were those that were most consistently placed in the same category by subjects. Thus, on the scales (class values) at the top and bottom of Figure 7, low numbers indicate more frequent and consistent groupings by subjects.

Starting from the left end of the cluster tree, the sewing machine operator and secretary were clustered at class value 1, as were the three infantry jobs of machinegunner, company commander and rifleperson. (Note, however, that two separate clusters are formed at step 1.) It was evident from the mean scores of the suitability rankings (see Table 10) that infantry jobs were considered less suitable for women. From the cluster tree, it was evident that subjects were very consistent in their judgments about suitability of those jobs for women.

By class value 3, the two nursing jobs had been clustered as a pair, squad leader had been added to the infantry cluster

FIGURE 7
CLUSTER ANALYSIS



(branch 1), and the two surgeon jobs had been clustered as a pair. By class value 6 (branch 2), all of the most traditional female jobs were clustered. Branch 3 seemed to include higher status, more traditionally masculine jobs, but jobs which could probably be performed equally well by both men and women. Branch 4 contained feminine jobs and the "job" of being a NPS student. By scale value 12 (branch 5), these two clusters had merged. At scale value 8, lumberjack and stevedore were paired, and at 11, garbage collector and coal miner were paired. By scale value 17 (branch 7), a cluster contained all of the infantry jobs and the Navy XO and CNO. Branch 8 contained the heavy labor jobs. By scale value 20, branches 7 and 8 were merged and cannoneer and Poseidon missile crew member were added to form branch 9. Branch 9 seemed to contain all traditionally masculine jobs. Branch 10 contained jobs requiring mechancial aptitude. By scale value 11, branches 9 and 10 had been merged and sewer worker, riveter and chaplain had been added. Branch 12 contained branch 5 as well as most jobs requiring light work of some kind. Thus, there appeared to be two main classifications: branch 12 occupations involved light work and branch 11 included traditional male occupations other than those involving light work. There were seven occupations, from assassin on down, which did not seem to group well and these groups could not be identified.

Infantry jobs were most consistently chosen as less suitable for women. Further, it made little difference whether the infantry job was as a company commander or rifleperson, since the four infantry jobs were clustered very early. Subjects did not distinguish between infantry jobs.

Further, two major clusters were evident as described in the previous paragraphs. No occupation in branch 12 required heavy labor; this was probably a major factor in determining judgments of suitability or unsuitability. Branch 11 contained all traditionally masculine jobs other than those requiring light work. The only exceptions to this criterion were the CNO, XO and chaplain. These jobs all involve light work. However, these jobs have been so strongly connected with men that it was felt that the masculinity of the jobs overrode the criterion separating branch 11 from branch 12. Thus, the technique clustered CNO, XO and chaplain under branch 11 instead of branch 12.

Figure 8 is an effort to summarize visually the results of the cluster analysis.

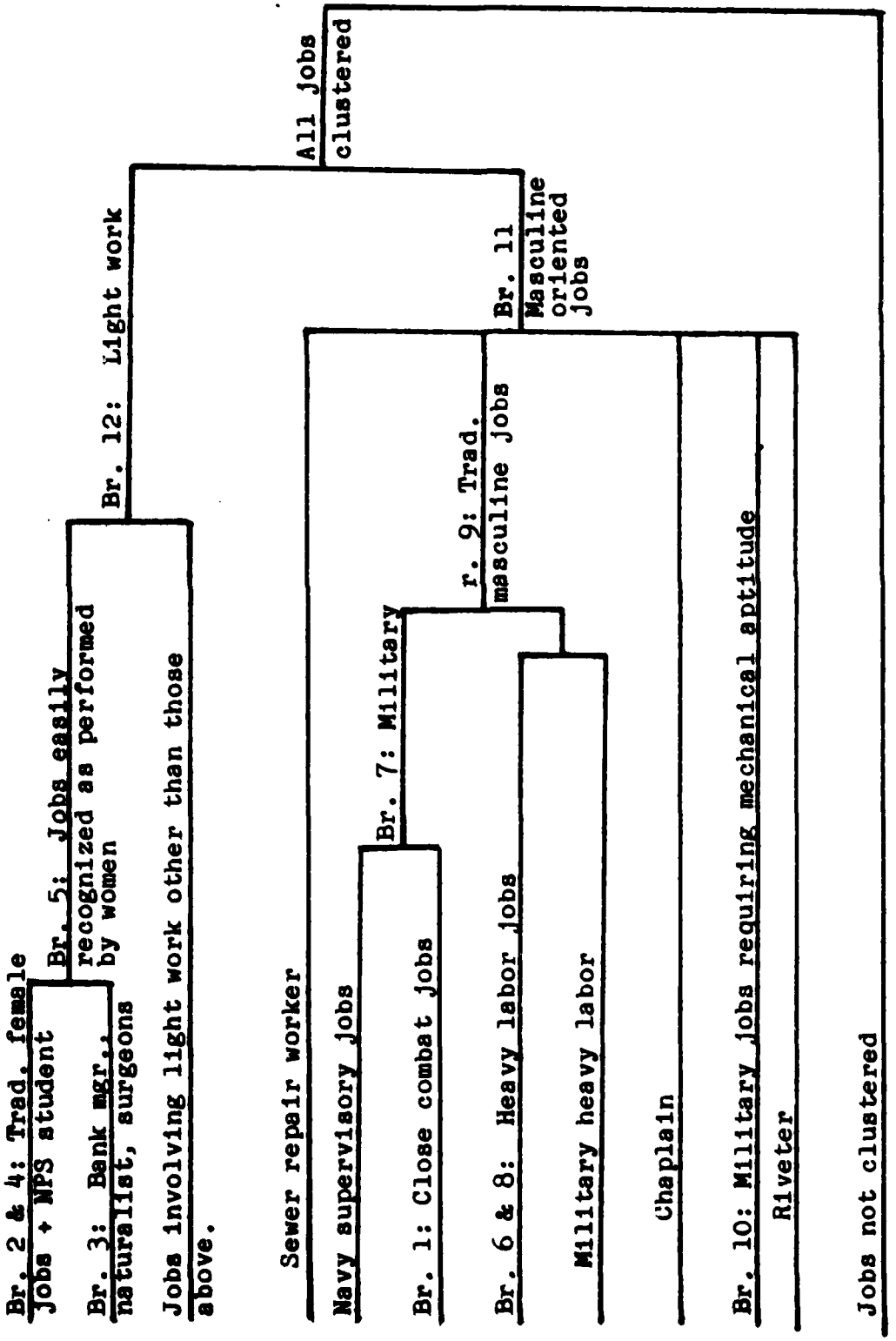
D. CONCLUSIONS OF THE PERCEPTIONS STUDY

Two major criteria of job suitability for women emerged from the analyses. The first criterion seemed to be tradition. The second criterion seemed to be light work. Thus, it appeared that jobs that have been traditionally held by women, were judged most suitable. This was evident from both the multidimensional scaling and the cluster analysis. Jobs that involved light working conditions were judged as next most suitable, e.g., surgeon, naturalist, bank manager. Jobs involving heavy labor, mechanical aptitude, infantry and strongly traditional masculine jobs were judged less suitable.

Of the original criteria that were considered as possible determinants of suitability, two were eliminated. These were dangerous/safe and clean/dirty. High wire performer and spy were

FIGURE 8

INTERPRETATION AND SUMMARIZATION OF THE CLUSTER ANALYSIS OF JOBS BASED UPON PERCEPTION OF SUITABILITY FOR WOMEN



included in branch 12. Both contain an element of danger. Janitor, considered to be a relatively dirty job, was also included in branch 12. No conclusion was possible with the life saving/life taking criterion. Medical professions were under branch 12, but chaplain was under branch 11. Assassin and medic were under neither branch.

Infantry jobs involve both heavy labor and a masculine orientation. Thus, for women, infantry jobs were considered as unsuitable as lumberjack or stevedore jobs. The data in Table X can be used to determine the average perceptions of the suitability for women of the 51 jobs included in the study.

VI. CONCLUSIONS AND RECOMMENDATIONS

This thesis attempted to extend to gender-integrated combat units the results of several studies of men in ground combat. It was found that women, in general, may not be as suited to ground combat as men. Men who were adequate combat fighters were, on average, more masculine, according to several criteria, than were non-fighters. Women, in general, obviously, are less masculine than men by these same criteria, e.g., SVIB M-F scores. Women, on average, are also less physically active, smaller in stature and weigh less than men. Differences between combat fighters and non-fighters on these factors were all found to be statistically significant. Although predictions about the fighting ability of individual women (or men) cannot be made with confidence, the findings suggest that on average, the ground combat fighting ability of women may not be as high as that of men.

Further, women may be handicapped in primary group interaction. Clark found that several informal leadership functions seemed important factors in squad aggressiveness and cohesiveness [Ref. 35]. In one factor, called sustaining, women might be able to make a substantial contribution to unit social integrity if they can overcome their reluctance to provide leadership. However, other studies (in civilian settings) showed that women may be less acceptable as leaders, or may even prove to be disruptive to primary group solidarity. The loss of social cohesion would probably prove disasterous in battle.

Important criteria by which the students at the Naval Postgraduate School judged the suitability of jobs for women, seemed to be on the basis of physical strength requirements and tradition. On this basis, resistance to the use of women in infantry might be expected. The subjects in this study were all military graduate students and different results might be expected if other populations were sampled. A poll on women in combat was recently taken by George Gallup. He reported that the nation was almost evenly divided on whether women should be drafted. Of the 43% who answered "yes," only 44% thought that women should serve in "combat" [Ref. 50]. The results of this national poll, support, in a general way, the conclusion that resistence to women in infantry may be encountered.

Finally, valid research in this area might be extremely difficult. The standard research tool (combat modeling) is not useful due to a lack of human performance data and a lack of adequate models to explain underlying psychological and social combat interactions. Also, field tests may not prove useful since one of the primary stresses in combat is the threat of death. Simulating this extreme form of stress does not seem feasible.

It is recommended that further research be done concerning how people judge the appropriateness of different jobs for women. Perception data should be more representative of the general population of adults. Further research should also examine what jobs women, themselves, feel qualified and interested in performing. The techniques of multidimensional scaling and cluster analysis are useful tools in accomplishing this research.

Further research needs to be done in the area of combat neurosis and the relation to women. The progress of combat neurosis in men has been fairly well documented and drop-out rates have been established for many different types of combat units, e.g., paratroopers, tank units, and infantry [Ref. 21]. The variables involved in these differing units need to be explored and inferences about women drawn, if possible.

It is further recommended that infantry units be integrated sexually only with extreme caution, if at all. The research reviewed by this thesis has indicated that men differ from women in several areas that seem to be strongly related to success in combat. Research has indicated that gender-integrated work groups differ in some ways from single-sex work groups, and it can be expected that integrated military units will differ from segregated units also. Integrated units may differ in ways that sharply reduce combat effectiveness. It is suspected that wholesale introduction of women into infantry units, without changes to training and doctrine would, in fact, serve to reduce combat effectiveness. At the very least, introducing women into the infantry would add a measure of uncertainty about the combat effectiveness of the ground forces.

Such effects might be reduced or even eliminated by proper training and utilization of infantry personnel. Thus, it is also recommended that research be done to determine what training and doctrinal changes, if any, may be required. If sexual integration of combat units is forced on the ground combat forces by court order or by law, then steps must be taken to utilize women properly and to maximize the effectiveness of the combat forces.

Finally, it is recommended that the ground forces take steps to increase unit cohesiveness and insure unit loyalty -- regardless of whether women are incorporated. The disturbing trends toward social disintegration and loss of unit loyalty reported by Gabriel and Savage, although disputed, seem to have some basis in fact. Enough is known about primary group relations that these trends, if true, could be reduced by proper application of the knowledge of small group behavior.

APPENDIX A

FIGHTER VERSUS NON-FIGHTER BEHAVIOR

I. What a Fighter Does in Combat

A. The fighter exposes himself to enemy fire more than others in order to:

1. Provide leadership (either as a normal function or as a replacement for the designated leader)
   a. in assaults and hazardous missions
   b. in getting men into good firing positions
   c. in getting men to fire
   d. in calming men or giving them confidence

2. Take aggressive action (exclusive of leadership role)
   a. by advancing toward enemy (firing)
   b. by firing effectively at enemy
   c. by volunteering for and performing hazardous missions

3. Perform supporting tasks under fire
   a. such as caring for or evacuating wounded or helping in body recovery
   b. or, bringing up ammo, repairing weapon, laying comm. wire, carrying messages

B. Under the same exposure to fire as others in the unit the fighter:

1. Leads men effectively (either as a normal function, or as a replacement for the designated leader)
   a. in getting them into good fighting positions, keeping them moving
   b. in getting them to fire
   c. in calming them, giving them confidence, checking them often
   d. in acting generally as a leader

2. Takes aggressive action (exclusive of leadership)
   a. by throwing grenades effectively
   b. by firing weapon effectively
   c. by volunteering for and performing hazardous duty

3. Exhibits high degree of personal responsibility
   a. by being the last man to leave a position
   b. by continuing on, though wounded
   c. by leaving a less hazardous task to help where needed

II. What a Non-Fighter Does in Combat

A. The non-fighter does not expose himself to more enemy fire than do others in the unit.

B. Under the same exposure to fire as others in unit, the non-fighter:

1. Actively withdraws or "bugs out," usually under fire

2. Withdraws psychologically
   a. stays in bunker or in trench when he should be moving
   b. refuses direct order to fire at enemy
   c. refuses direct order to evacuate wounded or dead
   d. refuses direct order to move from one position to another
   e. has to be forced at gun or bayonet point to obey an order
   f. freezes

3. Malingers
   a. leaves, throws away, or dirties parts of his weapon to make it inoperative
   b. stops fighting when only slightly wounded
   c. when he should be fighting, avoids his primary responsibility by carrying supplies or helping wounded buddy
   d. fails to fire at good target for fear of giving away his position
   e. sick (malingering)
   f. says he can't take it
   g. malingering in general

4. Defensively over-reacts
   a. imagines he "sees" and "hears" things; may fire his weapon or throw grenades at them

5. Becomes hysterically incapacitated
   a. trembles to such an extent that he is unable to hold or fire his weapon, or fires wildly
   b. breaks down and cries
   c. shaky and nervous

Adapted from Egbert, R. L. and others, Fighter I: An Analysis of Combat Fighters and Non-Fighters, U.S. Army Leadership Human Research Unit, p. 12-14, 1957.

APPENDIX B

PERSONALITY TESTS

The Minnesota Multiphasic Personality Inventory (MMPI) and the California Personality Inventory (CPI) are two psychological testing instruments. The MMPI was developed for use with abnormal individuals while the CPI was developed for use on a normal population. About half the items on the CPI were adapted from the MMPI. The MMPI is by far the more used of the two, and is widely used in clinics and as a research tool. A wide body of literature has grown up around the MMPI.

The MMPI was originally developed in a psychiatric hospital to distinguish among individuals suspected of suffering from psychological disorders. It consists of 555 items which the individual answers about himself. There are 9 different clinical scales. Each item may contribute to one or more of the 9 scales. The items that contribute to a particular scale are those that differentiate a particular pathological group from a group of normal individuals. The raw scores on each clinical scale are converted to standard scores with a mean of 50 and a standard deviation of 10. A graphical scale or profile is drawn up on each individual. Attention is focused on scores over 70 as indicating some mental imbalance or psychopathology. The original scales include hypochondriasis, depression, paranoia as well as others. Besides the 9 clinical scales, there are 3 verification scales used to detect conscious or unconscious lying. Several hundred other scales and keys have been developed over the years

to detect other personality characteristics such as social dominance, femininity and ego strength.

The difficulty with the use of the MMPI is that while there is extensive documentation of the original 9 scales, there is very little documentation of some of the other scales. Further, much of the literature is concerned with the interpretations of various profiles and coded profiles. Fighter I data were presented in mean raw scores for various scales rather than as standardized scores or profiles. Thus, comparisons with normal populations on the experimental scales was impossible.

APPENDIX C

QUESTIONNAIRE

Please circle one, and then write the number on the line provided at the right edge of the paper.

I am a: male = 1, female = 2 _____

Rate the following list of jobs on their suitability for women on a scale from 1 to 7 with 1 being ideally suited and 7 being totally unsuitable. Circle each rating and write the number in the space provided on the right hand edge of the paper.

	Ideally suited						Totally unsuited	
Example: Astronaut	1	(2)	3	4	5	6	7	2
1. Real Estate Agent	1	2	3	4	5	6	7	_____
2. Undercover Policeperson	1	2	3	4	5	6	7	_____
3. High Wire Performer	1	2	3	4	5	6	7	_____
4. Military Radio Repairperson	1	2	3	4	5	6	7	_____
5. Helicopter Crew Chief	1	2	3	4	5	6	7	_____
6. Social Worker	1	2	3	4	5	6	7	_____
7. Bookkeeper	1	2	3	4	5	6	7	_____
8. Military Truck Driver	1	2	3	4	5	6	7	_____
9. Military Dentist	1	2	3	4	5	6	7	_____
10. Medic (Infantry)	1	2	3	4	5	6	7	_____
11. Sewer Repair Worker	1	2	3	4	5	6	7	_____
12. Nurse (M.A.S.H.)	1	2	3	4	5	6	7	_____
13. Stunt Pilot	1	2	3	4	5	6	7	_____
14. Housewife	1	2	3	4	5	6	7	_____
15. Professional Assassin (CONUS)	1	2	3	4	5	6	7	_____
16. Squad Leader (Infantry)	1	2	3	4	5	6	7	_____
17. Garbage Collector	1	2	3	4	5	6	7	_____
18. Army Chaplain	1	2	3	4	5	6	7	_____

19. Lumberjack	1	2	3	4	5	6	7	_____
20. Stevedore	1	2	3	4	5	6	7	_____
21. Chief of Naval Operations	1	2	3	4	5	6	7	_____
22. Gran Prix Race Driver	1	2	3	4	5	6	7	_____
23. Steel Mill Foreman	1	2	3	4	5	6	7	_____
24. Minuteman Missile Crew Member	1	2	3	4	5	6	7	_____
25. Janitor	1	2	3	4	5	6	7	_____
26. Tank Mechanic	1	2	3	4	5	6	7	_____
27. Used Car Salesperson	1	2	3	4	5	6	7	_____
28. Spy (Overseas)	1	2	3	4	5	6	7	_____
29. Navy Intelligence Officer	1	2	3	4	5	6	7	_____
30. F-15 Pilot	1	2	3	4	5	6	7	_____
31. Naturalist	1	2	3	4	5	6	7	_____
32. Surgeon (M.A.S.H.)	1	2	3	4	5	6	7	_____
33. F-4 Radar Intercept Officer	1	2	3	4	5	6	7	_____
34. Anti-Aircraft Missile Crew Member	1	2	3	4	5	6	7	_____
35. Rifleperson (Infantry)	1	2	3	4	5	6	7	_____
36. Bank Manager	1	2	3	4	5	6	7	_____
37. Sniper (Infantry)	1	2	3	4	5	6	7	_____
38. Poseidon Missile Submarine Crew Member	1	2	3	4	5	6	7	_____
39. Military Pay Clerk	1	2	3	4	5	6	7	_____
40. Artillery Cannoneer	1	2	3	4	5	6	7	_____
41. Student (NPS)	1	2	3	4	5	6	7	_____
42. Surgeon (CONUS)	1	2	3	4	5	6	7	_____
43. Riveter	1	2	3	4	5	6	7	_____
44. Coal Miner	1	2	3	4	5	6	7	_____
45. Executive Officer (Destroyer)	1	2	3	4	5	6	7	_____
46. Nurse (CONUS)	1	2	3	4	5	6	7	_____
47. Sewing Machine Operator	1	2	3	4	5	6	7	_____

48. Machine Gunner (Infantry)	1	2	3	4	5	6	7	_____
49. Company Commander (Infantry)	1	2	3	4	5	6	7	_____
50. Small Arms Repairperson	1	2	3	4	5	6	7	_____
51. Secretary	1	2	3	4	5	6	7	_____

BIBLIOGRAPHY

1. "Army to Drop Higher Requirements for Women," Monterey Peninsula Herald, p. 6, May 19, 1979.

2. Marshall, S. L. A., Men Against Fire, William Morrow, 1947.

3. Dupuy, T. N., Lecture presented at Naval Postgraduate School on the history of women in combat, March 5, 1979.

4. Laffin, J., Women in Battle, Abelard-Schuman, 1967.

5. Stites, R., The Women's Liberation Movement in Russia, p. 317-332, Princeton, 1978.

6. Bailey, R. H., Partisans and Guerrillas, Time-Life Books, 1978.

7. Ray, J. W., "Women Who Could Be Warriors," Air War College, April, 1978.

8. Treadwell, M. E., U.S. Army in World War II, Special Studies, Vol. 5, The Women's Army Corps, Department of the Army, p. 770-771, 1954.

9. Hazleten, L., Israeli Women, The Reality Behind the Myth, Simon & Schuster, p. 150, 1977.

10. Wilson, E. O., On Human Nature, Harvard University Press, 1978.

11. Maccoby, E. E., Jacklin, C. N., The Psychology of Sex Differences, Stanford University Press, 1974.

12. Terman, L. M., Miles, C. C., Sex and Personality, Russell and Russell, 1936.

13. National Aeronautic and Space Administration, Vol. I: Anthropometry for Designers, 1978.

14. Heinl, R. D., Soldiers of the Sea, United States Naval Institute, 1962.

15. Dupuy, T. N., "How Lethal," Army, February, 1979.

16. Baldwin, H. W., Strategy of Tomorrow, Harper and Row, p. 156-157, 1970.

17. Marshall, S. L. A., Battle at Best, William Morrow and Company, 1963.

18. Egbert, R. L. and others, Fighter I: An Analysis of Combat Fighters and Non-Fighters, U.S. Army Leadership Human Research Unit, 1957.

19. Bonder, S., An Overview of Land Battle Modeling in the U.S., Proceedings 13th U.S. Army Operations Research Symposium, November, 1974.

20. Taylor, J. G., Lanchester-Type Models of Warfare, Unpublished paper, 1977.

21. Swank, R. L. and Marchland, W. E., "Combat Neuroses: Development of Combat Exhaustion," Archives of Neurology, v. 55, 1946, p. 236-247.

22. Adams, S. and others, Report of Working Group on Human Behavior Under Conditions of Military Service, Office of the Secretary of Defense, p. 313, 1951.

23. Kern, R. P., A Conceptual Model of Behavior Under Stress, with Implications for Combat Training, Department of the Army, p. 3-10, June, 1966.

24. Meeland, T., Egbert, R. L. and Miller, I., Field Stress: A Preliminary Study of Its Structure, Measurement, and Relation to Combat, U.S. Army Leadership Human Research Unit, 1957.

25. Terman, L. M. and Miles C. C., Sex and Personality, Russell and Russell, 1936.

26. Kern, R. P., A Review of Fighter I-VI, U.S. Army Leadership Human Research Unit, 1964.

27. Watson, P., War on the Mind, Basic Book, Inc., 1978.

28. Sherman, J. A., On the Psychology of Women: A Survey of Empirical Studies, Charles C. Thomas, 1971.

29. Tyler, L. E., The Psychology of Human Differences, p. 251, Appleton-Century-Crofts.

30. Hare, A. P., Handbook of Small Group Research, The Free Press, p. 5, 1976.

31. Moskos, C. A., The American Enlisted Man, p. 144-146, p. 243, Russell Sage Foundation, 1976.

32. Gabriel, R. A. and Savage, P. L., Crisis in Command, p. 38, 1978.

33. Shils, E. A. and Janowitz, M., "Cohesion and Disintegration in the Wermacht in World War II," Public Opinion Quarterly, p. 280, Summer, 1948.

34. Little, R. W., "Buddy Relations and Combat Performance," The New Military, Janowitz, M. (ed.), Russell Sage Foundation, p. 195-224, 1964.

35. Clark, R. A., Leadership in Rifle Squads on Korean Front Lines, U.S. Army Leadership Human Research Unit, 1955.

36. Dunphy, D. C., The Primary Group, Appleton-Century-Crofts, p. 25-26, 268-288, 1972.

37. Fehrenbach, T. R., This Kind of War, MacMillen Co., p. 172-173, 1963.

38. Faris, J. H., "An Alternative Perspective to Savage and Gabriel," Armed Forces and Society, p. 457-461, May, 1977.

39. Oppenheimer, V. K., "The Sex-Labeling of Jobs," Women and Achievement, Mednick, M. T. A., Tangri, S. S., Hoffman, L. W., (ed.), Hemesphere Publishing Corp., p. 318-320, 1975.

40. Hollander, E. P. and Yoder, J., Some Issues in Comparing Women and Men as Leaders, State University of New York at Buffalo, November, 1978.

41. Bartol, K. M., "The Sex Structuring of Organizations: A Search for Possible Causes," Academy of Management Review, October, 1978.

42. Kanter, R. M., "Women and the Structure of Organizations," Another Voice, Millman, M., Kanter, R. M., (ed.), p. 34-75, Anchor/Doubleday, 1975.

43. Kanter, R. M., "Why Bosses Turn Bitchy," Psychology Today, p. 56-59, May, 1976.

44. Heilman, M. E. and Kram, K. E., "Self-Derogating Behavior in Women - Fixed or Flexible: The Effects of Co-Worker's Sex," In press, Organizational Behavior and Human Performance, draft copy.

45. Tavris, C. and Offir, C., The Longest War, Sex Differences in Perspective, Harcourt Brace Jovanovich, p. 209-210, 1977.

46. Kruskal, J., "Part I: Multidimensional scaling by optimizing a goodness of fit to a non-metric hypothesis. Part II: Non-metric multidimensional scaling: a numerical method," Psychometrika, p. 1-27, 115-129, 29, 1964.

47. Burton, M., "Semantic Dimensions of Occupation Names," Multidimensional Scaling, Vol. II, Applications, Romney, K. A., Shepard, R. N., Nerlove, S. B., Eds., p. 55-71, Seminar Press, 1972.

48. The author was privileged to discuss the results of the multidimensional scaling study with Dr. Joseph Kruskal, co-author of KYST, at the 1979 annual meeting of the Psychometric Association held at the Naval Postgraduate School June 9, 10, 11, 1979. Dr. Kruskal indicated that a stress score of .1771 was high and perhaps other dimensions were involved.

49. Anderberg, M. R., Cluster Analysis for Applications, Academic Press, p. 131-138, 1973.

50. Gallup, G., "Americans Evenly Divided on Revival of Military Draft," San Jose Mercury News, p. 6A, April 29, 1979.

INITIAL DISTRIBUTION LIST

		No. Copies
1.	Defense Documentation Center Cameron Station Alexandria, Virginia 22314	2
2.	Library, Code 0142 Naval Postgraduate School Monterey, California 93940	2
3.	Department Chairman, Code 55 Department of Operations Research Naval Postgraduate School Monterey, California 93940	1
4.	Professor R.S. Elster, Code 54 (thesis advisor) Department of Administrative Sciences Naval Postgraduate School Monterey, California 93940	1
5.	Professor J.G. Taylor, Code 55 Department of Operations Research Naval Postgraduate School Monterey, California 93940	4
6.	LCDR W.F. Moroney, Code 55Mp Department of Operations Research Naval Postgraduate School Monterey, California 93940	1
7.	Capt. Phillip K. Carreon 9109 Cascus Drive Annandale, Virginia 22003	2
8.	Commandant of the Marine Corps Code OTTI-31 Headquarters Marine Corps Washington, D.C. 20380	1
9.	Commandant of the Marine Corps DCS RD and S Scientific Advisor (MC-RD-1) Headquarters Marine Corps Washington, D.C. 20380	1
10.	Chief of Naval Operations OP-10 Department of the Navy Washington, D.C. 20350	1

11. Chief of Naval Operations — 1
OP-13
Department of the Navy
Washington, D.C. 20350

12. Office of the Assistant Secretary of Defense (MRA & L) — 1
Attn: Director for Manpower Programs Analysis
The Pentagon Room 3E773
Washington, D.C. 20301

13. Office of the Assistant Secretary of the Navy (MRA & L) — 1
Attn: PDASN (M & RA)
The Pentagon Room 4E780
Washington, D.C. 20350

14. T. N. Dupuy Associates, Inc. — 1
P.O. Box 157
Dunn Loring, Virginia 22027